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Exotic plant invasions of federal Wilderness areas: Current status and future directions

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Summary

I conducted a survey of Wilderness areas to provide an initial overview of plant invasions in the National Wilderness Preservation System in the continental US and Alaska. A total of 333 Wilderness areas responded, and approximately 15% reported that exotic plants were among their top 10 management concerns. Many wilderness areas are actively dealing with control of exotic pest plants, while others have prioritized prevention of establishment. 70% of responding Wilderness areas do not monitor, inventory, or survey for exotic plants in any way. The majority of Wilderness areas reported that they have not been severely impacted by exotic plants, so it is important to emphasize prevention and early detection of exotic plant establishment.

Across all agencies, responses varied greatly between regions, with the highest priority being given to exotic plants by agencies in the California mediterranean region and the Rocky Mountain montane region. Wilderness areas managed by the National Park Service indicated greater overall awareness of exotic plants, and were far more likely to monitor or inventory Wilderness areas for exotic plants.

The greatest needs for most areas are increased funding, education and training in order to prevent further establishment of exotic plants. A range of natural disturbances facilitate exotic plant invasions, and it is therefore important to recognize that lack of, or low levels of, human disturbance does not preclude weed establishment.

It appears that without explicit goals and increased funding, it is difficult for many Wilderness area managers to prioritize exotic plant management. Many Wilderness areas have never been inventoried for exotic plants and, in general, there is little information on the distribution of exotics in Wilderness areas.

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Introduction

The 1964 Wilderness Act was passed to protect designated natural areas from human impacts, in order to preserve research and recreation opportunities and to protect the intrinsic value of natural areas and wildlife. Although legislatively protected, all Wilderness areas have been impacted to some degree by human disturbances (Cole and Landres 1996). Among these disturbances is the introduction of exotic species- those that have been transported by human activities beyond their native ranges, and are variously referred to as non-native, non-indigenous, or alien. Many of these plants have significant and measurable ecological effects on invaded ecosystems, and are considered pests or "weeds". The Wilderness Act mandates that Wilderness areas be managed to maintain their primeval character, so that the imprint of human activity is unnoticed, and therefore prioritization of pest plant control on a level with other human impacts is necessary for maintaining the natural character of Wilderness areas.

Increased global travel by humans and the resulting breakdown of geographic barriers to plant dispersal has dramatically increased the rate of intentional and accidental introductions of exotic species (Vermeij 1991, D'Antonio and Vitousek 1992, Lodge 1993, Vitousek et al. 1997). Changes in species' distributions are natural phenomena that operate on various time and spatial scales (Vermeij 1991, Lodge 1993); however, human mobility allows introductions at rates that are without precedent on the last several million years (D'Antonio and Vitousek 1992). The result is that "taxa which evolved in isolation from each other are being forced into contact in an instant of evolutionary time (D'Antonio and Vitousek 1992)." People move plants around the world intentionally for agriculture, horticulture, and also introduce plants unintentionally. Many plant species escape from cultivation and naturalize. The resulting exotic plant invasions have long been recognized as serious ecological problems (Leopold 1941, Stewart and Hull 1949, Elton 1958) and are increasingly considered one of the greatest anthropogenic threats to preservation of biodiversity and the regional distinctiveness of the planet (Soulé 1990, Vitousek 1990, 1994, D'Antonio and Vitousek 1992, Dudley and Collins 1995, Huenneke 1997). Unlike many human activities that can be restricted or eliminated within a Wilderness area, exotic plants can spread across political boundaries, and are often not detected until a serious problem has developed. It is estimated that over 4,600 acres of public land in the United States are taken over by exotic plants every day (Asher and Harmon 1995, DOI 1993).

The ecological effects of exotic species on ecosystems are varied and long lasting, and include changes in ecosystem structure and function (MacDonald et al 1989, Vitousek 1990, Walker and Smith 1997, Woods 1997). Impacts on ecosystem structure include decreased diversity and the prevention of native species recruitment (Tyser 1992, Busch and Smith 1995, Lesica and Shelly 1996), acceleration of local extinction rates, and deleterious hybridization between indigenous and non-indigenous species (MacDonald et al. 1989, Abbott 1992). Impacts on ecosystem function include accelerated erosion, alteration geomorphologic processes (Barbour and Johnson 1977, Graf 1978, Neill 1983), and alteration of biogeochemical cycling and hydrological cycles (Neill 1983, Vitousek et al. 1987, Ley and D'Antonio 1998). For these reasons, the presence of exotic plants in legally protected natural areas demands attention. Studies have addressed exotic plants in National Parks (MacDonald et al. 1989), in various natural areas of California (Dudley and Collins 1995), and on The Nature Conservancy preserves (Randall 1995), however the extent of plant invasions within the Wilderness Preservation System in largely unexplored.

Because exotic plant management is expensive, time consuming, and complex, researchers and managers need to identify priority areas to focus weed control efforts. Many researchers agree that relatively undisturbed areas should be high priorities for weed control efforts (Asher and Harmon 1995, Hobbs and Humphries 1995, MacDonald et al. 1989). Relative to other managed lands, Wilderness areas usually have more limited access, more natural conditions, and fewer impacts of human activity. Therefore, they are an appropriate focal point for prevention and control of exotic plant invasions.

In 1997 and 1998, I conducted an informal survey of managers of Bureau of Land Management (BLM), Forest Service (FS), Fish and Wildlife Service (FWS) and the National Park Service (NPS) Wilderness areas. The goal of the survey was to compile information on exotic plant species in order to identify research needs, generate awareness and facilitate information exchange about exotics in Wilderness areas. Three immediate objectives were to document the occurrence of exotic plant species in Wilderness areas and control efforts being used, identify factors contributing to exotic plant establishment and spread, and characterize the quality of available data. The resulting database is available over the Internet (www.umt.edu/biology/leopold). This report discusses the current status of exotic plants in Wilderness areas in the context of identifying research priorities and appropriate management actions for Wilderness preservation.

Terminology

Many words are used to describe non-indigenous plants. There is currently no universally accepted term, and human values frequently complicate terminology (Luken 1994). Terminology for exotic plants is problematic due to biological problems in defining the status of "native" or "indigenous" plants. It is difficult to define natives because of the naturally dynamic nature of species distributions and the relatively brief time frame in which we have been documenting those distributions (Webb 1985, Lodge 1993, Tausch 1993, Carlton 1996, Schwartz 1997). One commonly used temporal standard for determining the indigenous status of plants in

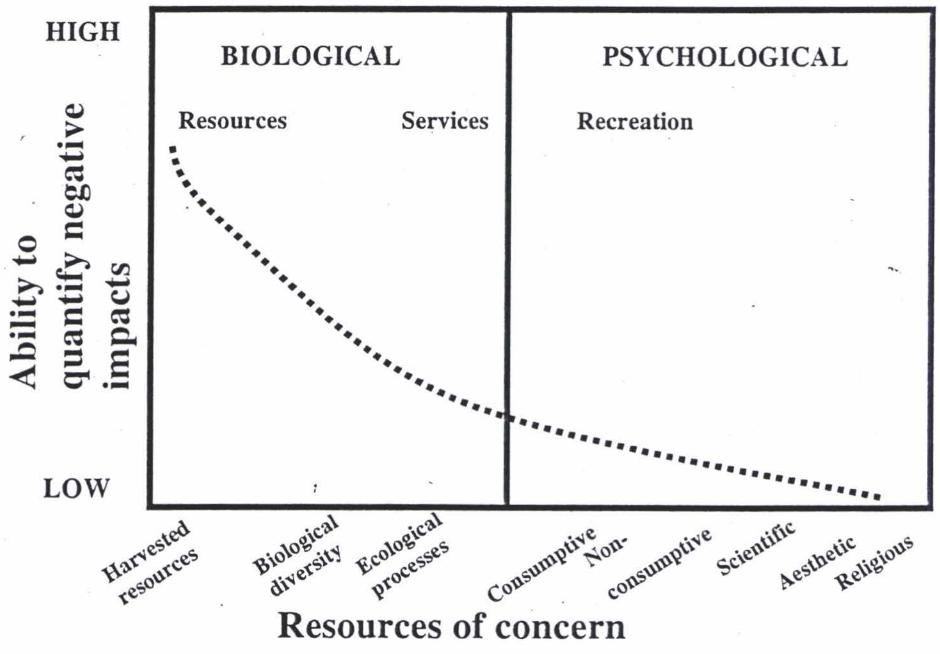


Figure 1. Extent to which exotic plant impacts can be quantified economically (from OTA 1993)

North America is pre- versus post- European settlement. This is often an appropriate reference point, since this time was when the rate of introductions was dramatically accelerated. However, it is still problematic since it overlooks the fact that indigenous people were practicing agriculture and introducing plants beginning 10,000 years ago (Webb 1985, Schwartz 1997). Nonetheless, pre- versus post- colonization is often a helpful standard to use.

The status of a given plant could be debated indefinitely, but the relevant task is when to determine that an exotic plant has become a problem. According to Loope (1992), the threshold is crossed when the introduced species results in a "significant decline in populations of one or more native species, significantly alters ecosystem processes, (or) causes aesthetic damage perceived to be unacceptable."

"Weed" is a commonly used, subjective term for any plant that is not wanted. This term can be confusing when used by different people in different contexts, but when management goals are clearly identified, defining weeds becomes straightforward (Randall 1997). It is easy to identify management goals in situations where benefits and costs can be assessed economically. For example, in crop systems, any plant that reduces crop yield (and therefore reduces profit) is a weed. When benefits of "weed" control are aesthetic, social, or scientific, it becomes more difficult to say which plants interfere with management goals, and why (Figure 1).

In the case of Wilderness management, the Wilderness Act provides guidelines for the definition of weeds. The Wilderness Act is intended to prevent or limit further human impacts on indigenous systems, not simply to provide recreational areas. In the Act, Wilderness is defined as undeveloped federal land, as "an area where the earth and its community of life are untrammeled by man…without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable." Wilderness areas are specifically "devoted to the public purposes of recreational, scenic, scientific, educational, and historical use (Wilderness Act 1964)." Some non-indigenous plants, inarguably introduced by human activities, have measurable deleterious effects on indigenous communities (Vitousek 1990, Woods 1997, Walker and Smith 1997). Such effects interfere with Wilderness management goals, and are therefore weeds, in line with the definition of Loope (1993) and Randall (1997).

For this report, "exotic" will be used for plant species that are not considered indigenous to a given area. "Weed" will be used for any exotic plant that has proven to be a nuisance or environmental threat by causing any of the problems mentioned above. In the survey reported here, respondents were asked to list all exotic plant species- even those that are not perceived as a threat. However, the majority reported only serious weeds, making generalizations about large-scale patterns in the number of exotics difficult.

Methods

A survey form (Appendix I) was distributed to all National Parks, National Forests, BLM offices, and National Wildlife Refuges that administer Wilderness areas. The survey form was intended to standardize responses on attitudes and priorities toward exotic plants, and to gather specific information on exotic species, management responses, and control efforts. Biologists were asked whether there was a weed management plan that applied to the Wilderness area, whether exotic plants were monitored in the Wilderness area, and to indicate the source of the information they were providing on the survey (e.g., best guess, systematic monitoring, etc.). They were also asked to rank the problem of exotic plants relative to other management issues.

Respondents were asked to list all exotic plants that they knew of or suspected in the Wilderness area, and to give a categorical ranking for the abundance and perceived threat of that plant. Space was provided to list research projects and control efforts for each species.

All of the survey responses were entered into a database (Microsoft Access for Office 97) with separate tables for contact information, species information (plant names, notes, pattern of infestation, control methods, and so on- see Appendix I for survey questions), and general information for Wilderness areas (questions 1-6 of the survey). In its current form, the database requires familiarity with Access or with general spreadsheet formats. Examples of possible queries include "Which Wilderness areas have leafy spurge present?", "Which are using herbicides to control salt cedar?", or "What are some contacts for mangers in the Northwest who have sweet clover in their Wilderness areas?"

Survey results

The response rate, quality of available information, and level of priority assigned to exotic species management all varied considerably within and between regions. For this report, results are discussed regionally, with each Wilderness area assigned to a biome (see below).

Overall, 322 designated Wilderness areas in 30 states responded by mail, phone, or email. There are 667 Wilderness areas in 44 states, and thus the responses represent 48% of federal Wilderness areas. Some Wilderness areas are managed by more than one unit; for example, the Lee Metcalf Wilderness in Montana is managed by the Gallatin National Forest, Beaverhead-Deerlodge National Forest, and the BLM. If each unit is considered a separate Wilderness area, there are 756 Wilderness areas, of which 342 responded (45%). This report treats each management unit as a separate Wilderness area, since available information, attitudes and projects vary from one unit to the next.

The number of responses from each agency was roughly proportional to the amount of Wilderness actually managed by that agency (Figure 2), with a bias toward Forest Service Wilderness areas. The weakness in BLM responses was due to the fact that none of the 75 BLM Wilderness areas in California responded to the survey when contacted by mail, phone, or email.

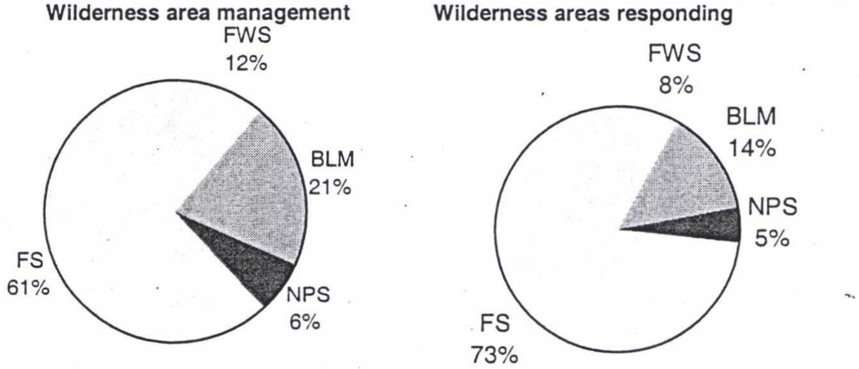


Figure 2. (a) Proportion of designated Wilderness areas managed by each federal agency. (b) Proportion of responding designated Wilderness areas from each agency.

Information was submitted from several natural areas that are protected but not federally designated as Wilderness. The BLM provided information on 30 Wilderness Study Areas (29 in southeast Oregon and 1 in Arizona). Additionally, Lake Mead National Recreation Area, the proposed Wilderness area of Glacier National Park, and the Adirondack State Park in New York,

Table 1. Response rate by agency in each state.

State	**Agency**	**#**	**#**	**Ppn**	**State**	**Agency**	**#**	**#**	**Ppn**
		managed	**responded**				**managed**	**responded**	
Alaska	FS	19	19	1.00	**Montana**	BLM	1	1	1.00
	FWS	21	10	0.48		FS	12	11	0.92
	NPS	8	2	0.25		FWS	3	2	0.67
Alabama	FS	2	1	0.50	**North Carolina**	FS	10	0	0.00
Arkansas	FS	10	6	0.60		FWS	1	0	0.00
	FWS	1	0	0.00	**North Dakota**	FWS	2	1	0.50
	NPS	1	0	0.00		NPS	1	0	0.00
Arizona	BLM	48	47	0.98	**Nebraska**	FS	1	1	1.00
	FS	36	30	0.83		FWS	1	0	0.00
	FWS	4	2	0.50	**New Hampshire**	FS	4	0	0.00
	NPS	4	2	0.50	**New Jersey**	FWS	2	0	0.00
California	BLM	74	0	0.00	**New Mexico**	BLM	4	2	0.50
	FS	51	35	0.69		FS	16	7	0.44
	FWS	3	2	0.67		FWS	4	3	0.75
	NPS	9	4	0.44		NPS	2	1	0.50
Colorado	BLM	2	0	0.00	**Nevada**	BLM	3	1	0.33
	FS	34	18	0.53		FS	14	8	0.57
	NPS	3	1	0.33	**New York**	NPS	1	0	0.00
Florida	FS	7	3	0.43	**Ohio**	FWS	1	0	0.00
	FWS	9	3	0.33	**Oklahoma**	FS	2	0	0.00
	NPS	1	0	0.00		FWS	2	0	0.00
Georgia	FS	10	10	1.00	**Oregon**	BLM	2	2	1.00
	FWS	3	0	0.00		FS	35	12	0.34
	NPS	1	0	0.00		FWS	2	1	0.50
Hawaii	NPS	2	0	0.00	**Pennsylvania**	FS	2	1	0.50
Idaho	BLM	1	0	0.00	**South Carolina**	FS	5	5	1.00
	FS	6	4	0.67		FWS	1	0	0.00
	NPS	1	1	1.00		NPS	1	0	0.00
Illinois	FS	7	0	0.00	**South Dakota**	FS	1	0	0.00
	FWS	1	0	0.00		NPS	1	1	1.00
Indiana	FS	1	0	0.00	**Tennessee**	FS	11	0	0.00
Kentucky	FS	2	2	1.00	**Texas**	FS	5	0	0.00
Louisiana	FS	1	0	0.00		NPS	1	0	0.00
	FWS	2	1	0.50	**Utah**	BLM	2	2	1.00
Massachussettes	FWS	1	0	0.00		FS	13	6	0.46
Maine	FS	1	0	0.00	**Virginia**	FS	17	0	0.00
	FWS	3	0	0.00		NPS	1	1	1.00
Michigan	FS	10	10	1.00	**Vermont**	FS	6	0	0.00
	FWS	3	0	0.00	**Washington**	BLM	1	0	0.00
	NPS	1	0	0.00		FS	24	12	0.50
Minnesota	FS	1	0	0.00		FWS	2	0	0.00
	FWS	2	0	0.00		NPS	3	1	0.33
Missouri	FS	7	0	0.00	**Wisconsin**	FS	5	5	1.00
	FWS	1	0	0.00		FWS	1	0	0.00
Mississippi	FS	2	0	0.00	**West Virginia**	FS	6	5	0.83
	NPS	1	1	1.00	**Wyoming**	FS	15	11	0.73

all of which have active weed control or monitoring programs, also sent valuable information. All of these areas provided detailed species lists and information on control efforts. Adirondack State Park represents the only response from the north eastern states (NY, VT, NH, ME), and the information provided by ecologists there should be helpful for federal land managers who lack data on problem species in their own Wilderness areas. Responses from these participating "non-designated" wilderness areas are included in the species list of this report, and in the database. Their responses are discussed, but are excluded from analysis.

A breakdown of response rate by state and agency is given in Table 1. All responses were from the continental United States and Alaska; the two Park Service Wilderness areas in Hawaii did not respond. For information on exotics in Wilderness areas of Hawaii, see Stone et al. (1993), which includes chapters on alien plants on Hawaii Volcanoes and Haleakala National Parks. The response rate is discussed for each biome.

Quality of available information, and ranking of exotics as a priority issue.

In addition to nonrandom participation in our survey effort, there were large differences between regions and between agencies in the quality of available information, and in the level of importance assigned to exotic plants in general. Overall, only about 31% of Wilderness areas reported some kind of monitoring or documentation of exotics (42% confirmed that they did not monitor, and 27% did not respond to the question). National Park Service Wilderness areas were the most likely to monitor exotic plants (Table 2). Fewer than 10% of respondents have written plans for weed management in the Wilderness area. Specific results of different regions are discussed below.

Table 2. Percent of Wilderness areas that monitor Wilderness areas for exotic plants, by agency.

BLM	46%
FS	29%*
FWS	32%
NPS	80%

*Excludes Wilderness areas that received the first version of the survey form, which did not include this question.

Overall, about 15% of respondents ranked exotic plants among their top 10 concerns, and 17% reported it as one of many small problems. About 42% said that exotic plants were not much of a problem in their Wilderness area (Table 3). Sometimes this was because exotics were not known or suspected to occur, but occasionally respondents indicated that management was not interested in exotic plants in general, or that Wilderness areas are lower priorities for active management. The level of importance assigned to exotic plants varied greatly among regions (Figure 3).

Regional organization

Wilderness areas from the Sonoran desert to the Arctic tundra reported problems with exotic plants. A list of biomes included are listed in Table 4. Biomes are those described in Barbour and Billings (1988). Organization of results by biome is intended to identify regional differences in the perception of exotic plants as a management priority, and to help interested parties

Table 3. Summary of responses by region.

		For this Wilderness area, exotic plants are-					Is there a weed management plan?			Are weeds monitored in the Wilderness?		
	# responses	Not much of a problem	One of many small problems	Significant; one of the top 10 priorities	Very important; one of 2 or 3 top priorities	no response	YES	NO	nr	YES	NO	nr
PacCoast/ Cacadian	48	33	2	4	0	9	10	17	21	23	4	21
		0.69	0.04	0.08	0.00	0.19	0.21	0.35	0.44	0.48	0.08	0.44
Intermtn& Palouse	11	4	4	2	0	1	0	10	1	7	3	1
		0.36	0.36	0.18	0.00	0.09	0.00	0.91	0.09	0.64	0.27	0.09
CAmontane	20	19	0	1	0	0	1	19	0	0	20	0
		0.95	0.00	0.05	0.00	0.00	0.05	0.95	0.00	0.00	1.00	0.00
CA medit	20	3	4	8	5	0	5	15	0	12	8	0
		0.15	0.20	0.40	0.25	0.00	0.25	0.75	0.00	0.60	0.40	0.00
Moj/SonDesert	104	38	24	14	4	24	5	84	14	26	64	14
		0.37	0.23	0.13	0.04	0.23	0.05	0.81	0.13	0.25	0.62	0.13
Rocky Mtn mont	69	5	3	6	11	44	14	9	45	20	2	46
		0.07	0.04	0.09	0.16	0.64	0.20	0.13	0.65	0.29	0.03	0.67
Central prairie	5	1	1	1	1	1	1	3	1	3	2	0
		0.20	0.20	0.20	0.20	0.20	0.20	0.60	0.20	0.60	0.40	0.00
Great Lakes	15	1	5	7	0	2	1.00	14.00	0.00	1.00	14.00	0.00
		0.07	0.33	0.47	0.00	0.13	0.07	0.93	0.00	0.07	0.93	0.00
Eastern Decid SW	9	8	1	0	0	2	0	9	0	3	6	0
		0.89	0.11	0.00	0.00	0.22	0.00	1.00	0.00	0.33	0.67	0.00
Appalachian forest	18	17	0	1	0	0	1	17		1	8	9
		0.94	0.00	0.06	0.00	0.00	0.06	0.94	0.00	0.06	0.44	0.50
SE coastal	14	3	6	4	0	1	1	13	0	7	7	0
		0.21	0.43	0.29	0.00	0.07	0.07	0.93	0.00	0.50	0.50	0.00
Tundra	9	8	1	0	0	0	0	9		2	5	0
		0.89	0.11	0.00	0.00	0.00	0.00	1.00	0.00	0.22	0.56	0.00
OVERALL	299	141	56	31	21	84	39	219	82	105	143	91
		0.42	0.17	0.09	0.06	0.25	0.12	0.65	0.24	0.31	0.42	0.27

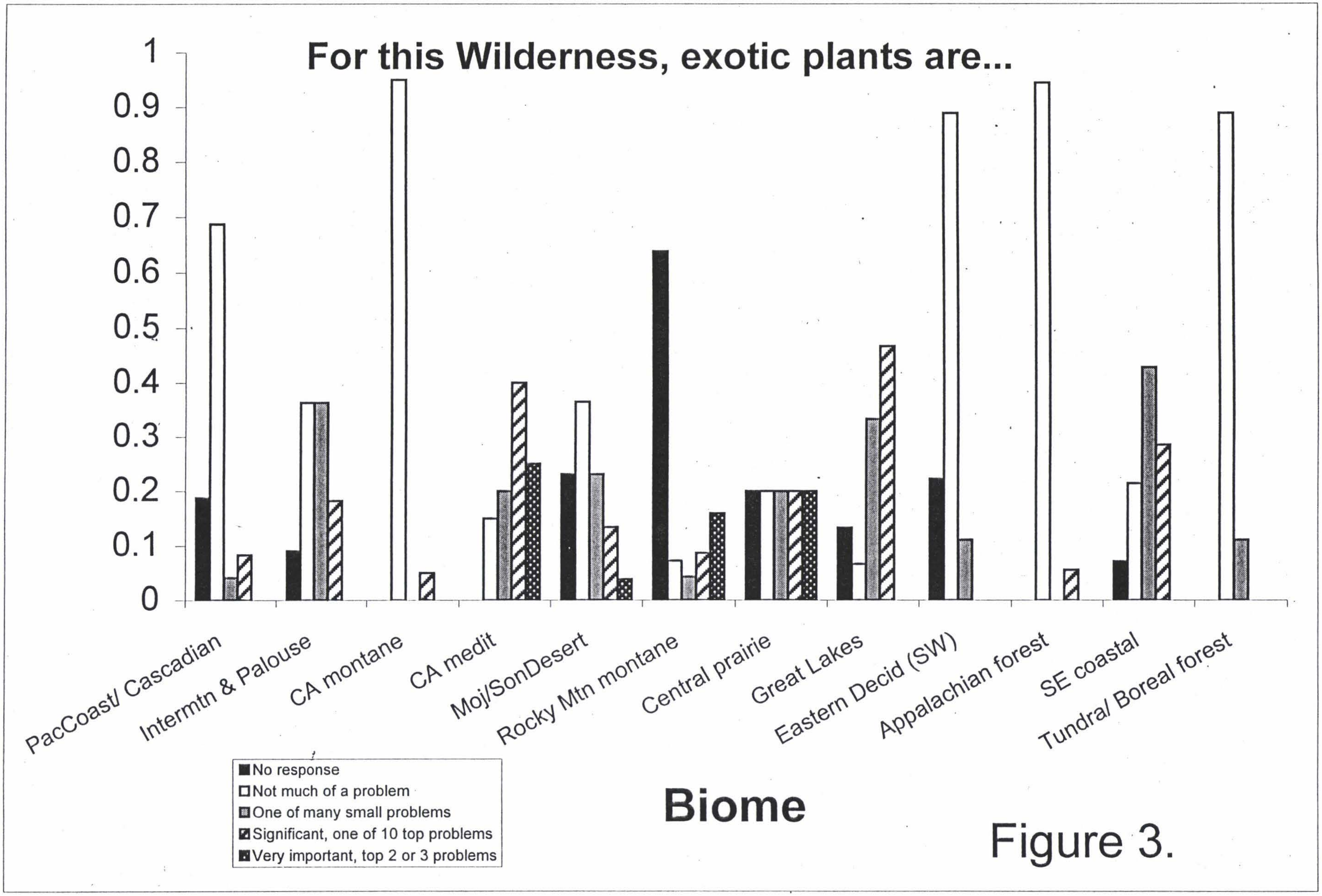

For this Wilderness, exotic plants are...
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
PacCoast/ Cascadian
Intermtn & Palouse
CA montane
CA medit
Moj/SonDesert
Rocky Mtn montane
Central prairie
Great Lakes
Eastern Decid (SW)
Appalachian forest
SE coastal
Tundra/ Boreal forest
■ No response
☐ Not much of a problem
▨ One of many small problems
▨ Significant, one of 10 top problems
▨ Very important, top 2 or 3 problems
Biome

Figure 3.

identify and prioritize plants that are likely to occur locally or regionally.

For convenience, the Arctic tundra and boreal forest are combined, as are the Pacific coastal and Cascadian forests, and Intermountain communities and the Palouse prairie. The eastern temperate forest biome is very large, and I discuss it in four subsections that are geographically convenient and biologically relevant: Appalachian forests, northeast states, Great Lakes, and the southwest states. A species list of exotics reported in each biome is given in Appendix II. Those interested should also see Loope (1993) for an overview of problem exotic plants in national parks and biosphere preserves on the United States.

Table 4. Biomes included for regional discussion (based on Barbour and Billings 1988)

- Arctic tundra & boreal forest
- Pacific coastal & Cascadian forests
- California mediterranean
- California montane
- Intermountain basin
- Northwest (Palouse) grassland
- Rocky Mountain montane
- Central prairie
- Eastern temperate forests
    - *Appalachian forest*
    - *Northeast states*
    - *Southwest states*
    - *Great Lakes*
- Southeast coastal marsh, swamp, bog, forests

Arctic Tundra/ Boreal forest

All respondents in this biome indicated that the low level of human disturbance and remoteness of the areas are not conducive to invasion by exotics. For example, Selawik NWR reported that no one on the current staff had visited the Selawik Wilderness area. Access is very difficult- either by foot through an adjacent Wilderness area, or by plane "if the wind is blowing in the right direction." It is unlikely that exotic plants have been introduced to such remote areas of Alaska.

Although 8 of 9 Wilderness areas reported that exotic plants are not much of a problem, a few exotic plants are found there, including some that cause problems in the lower 48 states. Several places reported the presence of cosmopolitan ruderal species (pineapple weed, dandelions, shepherd's purse), which do not appear to pose a threat to native plant communities, including pineapple weed (*Matricaria matricoides*), dandelion (*Taraxacum officinale*), shepard's purse (*Capsella pursa-pastoris*). Most Wilderness managers are not concerned with these species, but Denali National Park has an active exotic plant control program which includes pulling dandelion and vetch (*Vicia cracca*) (J. Balay, NPS, pers. comm.). In Denali, human impacts to the native vegetation are still relatively small, and dandelion invasion is viewed as a conspicuous imposition on management goals.

Serious pest plants have also been reported in this region. Bull thistle (*Cirsium vulgare*) has been found (and sprayed with herbicides) on private land 5 miles from the Izembek Wilderness boundary. Orange hawkweed (*Heiracium scabriusculum*), ox-eye daisy (*Chrysanthemum leaucanthemum,* syn. *Leucanthemum vulgare*), timothy (*Phleum pratense*), and white sweet clover (*Melilotus alba*) have been reported in or near Denali and/or Togiak. These plants cause considerable problems for natural area management in other parts of the United States, although no large problems have yet developed in Alaska. Denali National Park pulls dandelion, vetch, sweet clover, hawk weed and ox-eye daisy. No other controls efforts were reported.

Pacific Coastal/Cascadian Forests

This region ranges from southeastern Alaska to northern California, and the Wilderness areas range in elevation from sea level to over 8,000 feet. Only 8% of respondents ranked exotic plants among the top 10 problems. Those included Olympic National Park (WA) and the Middle Santiam Wilderness (OR), and the Okanogan National Forest portion of the Lake Chelan-Sawtooth Wilderness (WA) which are actively dealing with weed problems. The Leavenworth Ranger District portion of Alpine Lakes Wilderness (WA), has taken a proactive approach to preventing weed establishment in the Wilderness area (L. Therrell, Wenatchee National Forest, pers. comm.) There is the potential for weeds to spread from heavily infested roads and trailheads leading into the Wilderness area, and Forest staff have been aggressively hand pulling weeds at trailheads for the last six summers. Monitoring of weeds in general and of control efforts is informal and not funded.

In coastal and montane regions of Northern California, Oregon and Washington, little information was submitted for exotic plant distributions in Forest Service Wilderness areas. Biologists on the Six Rivers, Deschutes, and Mt. Baker-Snoqualmie National Forests confirmed that their Wilderness areas have never been inventoried for exotic plants. Although respondents did not expect that weed problems existed in these Wilderness areas, there was a general lack of information to assess the situation. Many biologists cited a lack of funding and staff for inventories. The Deschutes National Forest is seeking funding for weed projects, and has a GIS project to identify weed locations on the entire forest. While there is currently no information on the distribution of exotics in the Wilderness, trailheads have been identified as priority spots for weed monitoring, and weed populations near Wilderness areas are considered priorities for control (K. Grenier, Deschutes National Forest, pers. comm.).

The Wenatchee National Forest has been addressing a large infestation of common crupina (*Crupina vulagris*) in the Lake Chelan Wilderness area. The infestation was reported by a hiker, and was already quite large when noticed. The forest had several years of funding for hand pulling; however when funding ran out, work stopped, and the soil disturbance from pulling may have contributed to further spread of the weed (K. Dull, Wenatchee National Forest, pers. comm). The population is not currently being monitored or controlled, even though common crupina is a noxious weed in the state of Washington ("noxious weed" is a legal category, and noxious weeds legally require control efforts).

Olympic National Park has a large amount of information on exotics, and indicated a strong awareness and interest in dealing with the problems. In California, Oregon and Washington, common burdock (*Arctium minus*), ox-eye daisy (*Chrysanthemum leucanthemum,* syn. *Leucanthemum vulgare*), tansy ragwort (*Senecio jacobaea*), Scotch broom (*Cytisus scoparius*), and St. Johnswort (*Hypericum perforatum*) were the most widely reported problem species.

Biologists in southern and coastal Alaska reported that weeds were not a problem in their Wilderness areas, due to their remoteness and inaccessibility. However, due to the same logistical limitations, most did not have specific information. While no exotics were reported for the Alaskan Wilderness areas in this biome, biologists and managers should be aware that problem species have been found elsewhere in Alaska (see Tundra/Boreal Forest).

California mediterranean

Wilderness areas in the California mediterranean biome were more likely to report exotic plants as a high priority than any other (Figure 3). Of those that responded, 65% considered exotic plants to be at least among the top 10 management concerns, and 11 of 19 monitor exotics in the Wilderness in some way. These Wilderness areas are at lower elevations than in many regions, and therefore probably have more susceptible habitat. At the Phillip Burton Wilderness area of Point Reyes National Seashore, exotic plants are the single biggest vegetation management problem, especially since a large fire in 1995 which was followed by an explosion of weed populations (K. Cooper, NBS, pers. comm.). Throughout California, native perennial grasses have largely been replaced by exotic annual grasses following European settlement. The replacement is so complete that the original grassland communities are virtually unknown (Heady 1977, Jackson 1985). These exotic annual grasses now also make up a significant portion of understory in chapparal/scrub communities. Biologists on the Los Padres National Forest reported that annual brome grasses have displaced native plants and are altering fire regimes, but no control efforts are underway (nor do they seem feasible). Salt cedars (*Tamarix* species) and yellow star thistle (*Centaurea solstitialis*) were the most often reported problem species known or suspected to occur in Wilderness areas in the mediterranean biome. On the Los Padres National Forest, salt cedar is being treated by cutting and herbicide application to stumps, and by manual removal by a volunteer group which has an annual work day on the Ojai Ranger District (T. Austin, Los Padres National Forest, pers. comm.).

California montane forests

Wilderness areas of the Sierra Nevada in California reported few weed problems. These Wilderness areas occur mostly at high elevations (although many span several thousand feet), and all 19 that responded expected elevation to limit exotic plant invasions. For example, exotic plants of concern in Sequoia-Kings Canyon occur mostly below 4,000 feet, and the Wilderness boundary begins above 4,000 feet (P. Whitmarsh, USGS, pers. comm.). However, yellow star thistle (*Centaurea solstitialis*) has been found at Tuolomne Meadows in Yosemite National Park, at an elevation of 8,600 feet (S. Fritzke, National Park Service, pers. comm.). Although it is uncertain whether the plants (which were spotted and removed immediately) would be able to complete their life cycle at this elevation, biologists on the Sierra National Forest and in Yosemite National Park expect that strong prevention efforts will be necessary to avoid establishment of this major pest plant even at high elevations.

The few exotics that do occur in the high elevation portions of the Wilderness areas were probably brought in with livestock and packstock (J. Shevock, Region 5 Headquarters, L. Tanner, Sequoia National Forest, pers. comm.). Musk thistles (*Carduus* species) are suspected to occur near high elevation lakes on the Sequoia National Forest. Kentucky bluegrass (*Poa pratense*) is well established at higher elevations in Sequoia-Kings Canyon Wilderness area. Many Wilderness areas in the Sierra have been or are currently grazed by livestock, a disturbance which was reported to increase susceptibility to exotic plant invasion. See Dudley and Embury (1995) for an in-depth discussion of grazing in California wilderness areas.

At lower elevations, annual bromes (*Bromus tectorum*, *B. madritensis* ssp. *rubens*, *B. diandrus*) are well established. The exotic grass *Vulpia myuros* and yellow star thistle *(C. solsititialis)* are problem invaders at low elevations.

Few exotics are known to occur in California montane Wilderness areas, but 16 of 19 areas that responded have not been inventoried for weeds, and indicated that their data were too rough for confident assessment of the problem. However, Sequoia and Inyo National Forests are both beginning weed inventories in 1998, which will probably include parts of some Wilderness areas, and the Modoc National Forest is preparing a noxious weed Environmental Impact Statement which includes the South Warner Wilderness. The Tahoe National Forest depends on volunteers and knowledgeable hikers for reports of weed populations in the Granite Chief Wilderness - this is probably the case for other forests, too, which do not currently have funding for weed inventories. Yosemite and Sequoia-Kings Canyon National Parks have more active exotic plant inventory programs than the Forest Service Wilderness areas.

Intermountain basin and Palouse prairie

These biomes were combined since there are relatively few Wilderness areas in each. Nearly 20% of responding Wilderness areas ranked exotic plants as among the top 10 priorities. Nine of the eleven Wilderness areas included in this biome are on the Humbolt-Toiyabe National Forest in Nevada, where an exotic plant prevention program, including an Environmental Assessment for weed control, is currently under development. The Forest is in the process of documenting specific occurrences of weeds in Wilderness. Most of the Forest's information and focus on weeds is for areas outside Wilderness, since problem infestations are generally thought to be outside of Wilderness boundaries. The exception is cheatgrass (*B. tectorum*), which is limited to lower elevations of Wilderness areas (C. Jean, Humbolt-Toiyabe National Forest, pers. comm.).

Although weeds are identified as a high priority on Forest Service lands in Nevada, monitoring and documentation of exotics only occurs when staff visit Wilderness areas for other purposes. In other words, this work is getting done without specific allocated funding. The Humbolt-Toiyabe National Forest reported using biocontrols and herbicides for leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*) and toadflax (*Linaria* spp.) outside of Wilderness areas.

Lake Mead National Recreation Area (which is not a designated Wilderness area) is dealing with many weed problems, especially salt cedar (*Tamarix ramosissima*). Grubbing, cutting followed by herbicide application, and burning are all employed against this pest. Other priority plants for control are the exotic palms *Phoenix dactylifera* and *Washintonia filifera*, which have spread from plantings as ornamentals. Eradication of these plants is controversial because the public finds them attractive and desirable (E. Powell, National Park Service, pers. comm.).

Sonoran and Mojave Deserts

This biome includes Wilderness areas in California, Arizona, and New Mexico. The response rate was high from Arizona and New Mexico, but only a few responses were received from California. Since the BLM recently acquired the 69 Wilderness areas in this biome under the California Desert Protection Act of 1994, there may be little information available. At almost 4.3 million acres, it is a vast amount of land.

While fewer than 10% of respondents ranked exotic plants among their top 10 priorities, at least 40% of responding Wilderness areas have no information available on exotics in Wilderness areas. However, the Gila National Forest in New Mexico and most of the BLM field offices in Arizona have done exotic plant surveys in Wilderness areas and have found very few exotics. In contrast, Organ Pipe Cactus National Monument and Saguaro National Park are dealing with many problem exotic species. In these parks, and in several of the Arizona BLM Wilderness areas, problems with exotic plants are mostly restricted to lower elevation, desert communities while the higher elevation pine and chapparal communities have few weed problems.

Organ Pipe Cactus National Monument is targeting buffelgrass (*Pennisetum ciliare*) for control in 1998-99. Felger (1990) compiled an extensive list of exotics at Organ Pipe, with a discussion of the types of exotics (i.e. disturbance dependent, capable of invading intact communities, etc). This report is a good resource reference for the region. In 1990, the total proportion of actual and "potential" exotic species in the flora was 11.5%. Felger states that this low proportion is indicative of a healthy ecosystem. Although the proportion is low, several of those species area capable of dominating vast acreage, with significant ecological impacts, and thus abundance, and not just the number of species, needs to be considered.

Red brome (*Bromus rubens*), fountain grass (*Pennisetum setaceum*), buffelgrass (*P. ciliare*), black mustard (*Brassica tournefortii*) and salt cedar (*Tamarix ramosissima*) were the most widely reported weeds of the Sonoran desert. Red brome, fountain grass and buffelgrass alter fire regimes, and *Tamarix* can alter hydrology. Fire suppression and subsequent big fires, along with intense grazing history, were widely reported causes of weed establishment and spread.

Rocky Mountain montane forests

About 45 Wilderness areas in the Rocky Mountain region received an early version of the survey form that did not include all of the questions which were present in the final version, including the question to rank exotics plants relative to other management issues. Among those that did responded to the all the question (24 Wilderness areas), 68% ranked exotic plants among the top 10 management priorities, 58% have some kind of weed management plan that includes the Wilderness area, and 87% reported that exotics are monitored in the Wilderness area. Many of the surveys were completed by a "noxious weed specialist," a position rarely found in other regions. This alone indicates that weeds are a high priority.

Widely reported exotic plants included Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea maculosa*), hound's tongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), toadflax species (*Linaria dalmatica*), mullein (*Verbascum thapsus*) and sulfur cinquefoil (*Potentilla recta*). Many Wilderness areas reported manual control efforts, regular herbicide treatments, and biological control of these and other plants in and immediately adjacent to Wilderness areas. Control efforts with user groups are also in place. For example, the Frank Church- River of No Return (FC-RONR) has a hand pulling campaign along the Salmon River. The river corridor is a heavily used area where many of the weed problems are focussed, and thus the volunteer pulling program has two benefits. It results in some weed control in the heavily impacted areas, and it helps to educate Wilderness users about exotic plants as a conservation problem (B. Anderson, Nez Perce National Forest, pers. comm.).

Many Wilderness area mangers in this region recognize the value of early detection. Several Wilderness areas, including the FC-RONR, Absoroka-Beartooth, Selway-Biterroot and Glacier National Park (proposed Wilderness) provide weed identification training for all backcountry rangers in order to detect outbreaks early, and conduct regular inventories of high use areas. They also maintain weed databases to record locations and densities of problem weeds. Such databases allow for follow-up control treatments and monitoring of new problem spots. The backcountry weed report forms from Glacier and Absaroka-Beartooth are included in the Appendix.

Central prairie

There are only five Wilderness areas that represent the central prairie biome. Prairie systems are poorly represented in the National Wilderness Preservation System, with only 10 federal Wilderness areas (Landres and Meyer, *in press*). Of the five responding, two ranked exotics as significant problem, and 3 out of the 5 do some kind of monitoring of exotics in the Wilderness. The fact that these are at lower elevations probably contributes to weed problems. Canada thistle (*Cirsium arvense*) was the most widely reported (by 4 of the Wilderness areas), followed by smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratense*) and leafy spurge (*Euphorbia esula*). The extent of invasion seems to be small enough that these could be addressed; however, populations of spotted knapweed, Canada thistle (at Badlands) and leafy spurge (at Medicine Lake) are increasing despite biological and mechanical control efforts. Populations of salt cedar and sweet clover are expanding in places where there are no control efforts.

Eastern temperate forest

This is a tree-dominated biome, in which the woody taxa are mostly winter deciduous (Greller 1989). This biome covers most of eastern US, and is usually divided into many sub-regions (see Greller 1989). Response rate was low overall for this biome, and exotic plants are apparently not as widely perceived as a problem in eastern states. Many agency employees, including the Forest Service's Eastern Regional Wilderness Coordinator said that there are few weed problems in eastern states; however, the Nature Conservancy and a few federal biologists reported several exotic plant concerns.

For convenience, I will discuss 4 subsections (Great Lakes, Southwest, Appalachian, Northeast). Overall, about 20% of Wilderness areas ranked exotics as a significant problem, although this varied greatly among sub-regions.

Great Lakes (Michigan and Wisconsin Wilderness areas)

Seven of 14 areas ranked exotics as a significant problem. Although most Wilderness areas had not been inventoried, several had lists of exotic plants likely to be found there. One botanist sent a list of invasive plants reported in the Forest Service eastern region- this list had 57 exotic invasive species, 10 native invasive species, and over 150 widespread exotics that are not considered invasive. Of these, 37 were known or suspected in Wilderness areas on the Hiawatha National forest (14 of these are considered invasive).

Nordhouse Dunes Wilderness in Michigan has a noxious weed program and is manually removing exotic poplars (*Populus nigra*) and St. Johnswort (*Hypericum perforatum*), which are not thought to be spreading anymore. About 50 acres of spotted knapweed (*Centaurea maculosa*) were manually removed in 1997 (this took 10 people, plus advise from Nature Conservancy employees). Although it is still early to determine the effectiveness, the populations seem to be spreading despite these efforts. This is also the case for spotted knapweed in the Round Island, Big Island and Horseshoe Bay Wilderness areas on the Hiawatha National Forest in Michigan, where spotted knapweed has been hand pulled for the last 1-3 years. The Hiawatha National Forest does not have staff available to prepare a noxious weed plan, although it seems like this is justified (J. Shultz, Hiawatha National Forest, pers. comm.).

In northern Wisconsin, at least 44 exotics have been verified in wilderness areas, including the major pests spotted knapweed and Japanese barberry (*Berberis thunbergii*). All five Forest Service Wilderness areas in Wisconsin are small, surrounded by roads, and have been logged at some point (Q. Sheehan, Chequamegon-Nicolet National Forest, pers. comm.). There are no control efforts for exotics at this time, and exotics are not monitored. The available information is based on a botanical foray in 1996 into Whisker Lake Wilderness area (Blackjack and Headwaters are expected to be similar), and on long term monitoring plots in the Rainbow

Lakes and Porcupine Wilderness areas (these plots were selected randomly, and may not reflect the situation at more disturbed sites such as edges and trails).

Southwest states (Alabama, Arkansas, Kentucky)

No Wilderness areas in these states ranked weeds among their top 10 priorities, and exotics are monitored in only one of the nine responding areas. An interesting aspect of the species list from Arkansas is that many of the pest species are native plants which have become invasive. Botanists in this area complained that many agencies are actively planting aggressive exotic species for wildlife forage and erosion control. For example, the Ouachita National Forest and other agencies in Arkansas widely plant lespedeza (*Lespedeza cuneata*) for wildlife forage. Yet Ouachita National Forest has spent several thousand dollars trying to control this same plant in the last few years (W. Owen, Ouachita National Forest, pers. comm.) Widely reported problem species were mimosa (*Albizia julibrissina*), rose (*Rosa multiflora*), privet (*Ligustrum* species), Russian olive (*Elaeagnus* species), kudzu (*Pueraria montana,* also reported under the synonym *P. lobata*; see Ward [1998]) and Japanese honeysuckle *(Lonicera japonica*). The latter 3 species were originally intentional introductions, which later became invasive. Wilderness areas in Kentucky are adjacent to wildlife management areas, where aggressive exotics are planted as wildlife forage as well (D. Taylor, Daniel Boone National Forest, pers. comm.). Although agencies have not prioritized exotic plants as a management concern, several respondents considered exotic plants to pose a serious threat to natural areas in this region,

Appalachian forest (Georgia, Pennsylvania, South Carolina, Virginia, West Virginia)

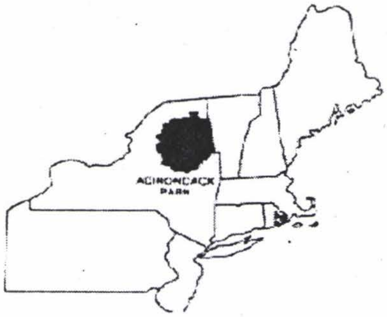
Hickory Creek Wilderness in Pennsylvania is included in this section for convenience; this is the only Forest Service Wilderness area that had any information on exotic plants. The other 16 that responded confirmed that they had no information on exotics in the Wilderness areas, but they were not expected to be a problem there. A botanist in West Virginia estimated that 60% of the Monongahela National Forest flora is composed of naturalized exotics, and considerably fewer than that are considered problem "weeds" (J. Concannon, Monongahela National Forest, pers. comm.). However, they had no information on exotic plant distribution in Wilderness areas, since weed surveys are done in conjunction with rare plant surveys and at silvilcultural sites, neither of which occur in Wilderness.

In contrast, exotics in Shenandoah National Park in Virginia are considered a significant management concern, and are monitored in the Wilderness portion. The aggressive weeds garlic mustard (*Alliara petiolata*), kudzu (*Pueraria montana)*, Japanese knotweed (*Polygonum cuspidatum*), Japanese honeysuckle (*Lonicera japonica*), and tree-of-heaven (*Ailanthus altissima*) have all been found in this Wilderness area. Some of these plants are treated or monitored, but the garlic mustard is too widespread for either.

Perhaps Shenandoah has a worse weed problem than other Wilderness areas in the Appalachians, because as a National Park it may receive more visitors. Several studies have shown that the number of visitors to a natural area is correlated with the number of exotic plants present (MacDonald 1985, Lesica et al. 1993). Although it seems likely that Wilderness areas throughout the Appalachians would have similar exotic plants, but other agencies have not attempted to document exotic species in their Wilderness areas.

Northeast States (New Jersey, New York, Vermont, New Hampshire, Maine, Massachusetts)

None of the 17 federally designated Wilderness areas in the northeast states responded. One Forest Service biologist in Vermont indicated it would be difficult to respond to the survey without a better definition of "exotic," since a large component of their flora is composed of naturalized species. Fortunately, Adirondack State Park, a large wilderness area managed by the state of New York, did submit information on their exotic plant concerns. Historically, there has been little attention given to exotic or invasive species in the Park (except for the Lake Champlain area and the St. Lawrence Valley, which are outside the wilderness areas, and have problems with water milfoil (*Myriophyllum spicatum*) and purple loosestrife (*Lythrum salicaria*). Wilderness areas of Adirondack Park fortunately do not currently have many problem exotic plants, and the Nature Conservancy staff is prioritizing prevention for these wilderness areas. While those exotics that are present appear to be restricted to roads and trails, they expect that some problem plants may be establishing in remote areas. They are conducting a survey of exotics this year in order to identify problems and preventative actions needed to maintain the natural plant communities (B. Brown, Adirondack Nature Conservancy, personal communication). Their "watch out" list includes crown vetch (*Coronilla varia*), garlic mustard (*Alliaria petiolata*), Eurasian water milfoil, black locust (*Robinia pseudoacacia*), and others listed in Appendix II.



Status of exotic plants in Wilderness areas of Vermont and New Hampshire may be similar to Adirondack State Park, which is managed by state agencies and The Nature Conservancy.

Southeast coastal, bog, forest, swamp

Seven of 14 responding Wilderness areas in this biome monitor exotics, and 29% of respondents ranked exotics as a significant problem. Biologists in this region were aware of and concerned about exotics. Managers knew where their exotic plant problems were, and could confirm confidently that there were few weed problems in Wilderness areas. Almost all respondents were using combinations of mechanical and herbicide treatments to control weeds in and near Wilderness areas. Tom Wilmers at the National Deer Key Refuge reported that they have successfully controlled exotics by detecting problems early, acting quickly, and following up on treated sites:

> "The key to success for the referenced areas was that the exotic pest plant problem was addressed while still relatively small, albeit widespread. Finding infestations in the early stages made control a feasible endeavor without need for additional funding. Too often, there is inaction because the extent of the problem seems initially overwhelming. Funding is understandably sought to attack the problem. But meanwhile, the problem grows, requiring ever greater amounts of manpower and money. While awaiting funding, several years may elapse, and thus it is important to take expeditious action using available resources (i.e. volunteers). It is amazing what a few committed individuals can accomplish."

Wilderness areas on the Apalachicola and Ocala National Forests in Florida are checked for exotics and are not known to have any weeds. However, aggressive exotic species are close enough that they are considered a serious threat. Japanese honeysuckle (*Lonicera japonicum*), Chinese tallow tree (*Sapium sebiferum*), and privet (*Ligustrum sinense*) were the most widely reported species throughout the region.

Mechanisms of spread in Wilderness areas

Both natural disturbance and disturbances associated with human activity contribute to the establishment and spread of exotics in Wilderness areas. Common human disturbances listed as causal agents included livestock use, trail use, camping, and existing roads adjacent to Wilderness areas. Not surprisingly, land use history prior to Wilderness designation had a large effect on the extent of non-native plant distribution. Historical and active grazing allotments were often cited as sources of exotic plants (Rutman *in press*, D. Isle, Mendocino National Forest, pers. comm.). Dudley and Embury (1995) discuss grazing impacts in California Wilderness areas in detail.

Natural disturbances, including gopher pockets, floods, storms, and fire were also reported to contribute to weed establishment or spread. There is a growing understanding of the role of natural disturbance in shaping natural communities and ecosystems (Sprugel 1991, Cole and Landres 1996). Paradoxically, reintroducing natural disturbances into Wilderness ecosystems may facilitate exotic plant invasions.

Many respondents reported fire as an important factor of weed spread, both in areas that are not adapted to fire (e.g., desert communities) and in areas that area adapted to fire (Rocky Mountain states) (B. Anderson, A. Sanger, S. Rutman, S. Fritzke, personal communications). There are documented cases that some exotics will respond positively to a fire, then alter the fire regime to the exotic species' favor, resulting in a positive feed back loop which maintains the exotic community (D'Antonio and Vitousek 1992). There also appears to be a plethora of anecdotal evidence on the relationship between fire and exotic plant invasion, as far back as an essay by Aldo Leopold (1941). Biologists from the Mojave and Sonoran deserts, Great Basin, and California mentioned that exotic annual grasses cause more frequent fires, which promote exotic grass expansion and suppress native species. Similar feedback loops have been documented for soil nutrients (Vitousek et al. 1987) and soil salinity (Brotherson and Winkel 1986, Shafroth et. al. 1995).

The phenomenon of plant invasions is so complex that it is difficult to identify any single or few factors that are responsible across large scales. Sue Rutman, plant ecologist for the National Park Service, pointed out that many things contribute to the current distribution of exotic species at Organ Pipes National Monument. While areas with grazing impacts are often the most impacted by exotics, other problem areas exist where fires have destroyed native plant communities. Furthermore, species that depend on soil disturbance can colonize rodent mounds or other completely natural disturbances, and some species, include fountain grass (*Pennisetum ciliare*) will move into areas that have no apparent disturbances at all (S. Rutman, Organ Pipe Cactus National Monument, pers. comm.).

It is important to emphasize that, while many invasive species depend on some level of disturbance to establish, the disturbance does not have to be large, nor does it have to be the result of human activity, for some exotic weeds to become established. We should not assume that the lack of recent disturbance precludes invasion by exotic weeds.

Appropriate management responses

Prevention and early detection

The highest priority should be given to prevention of weed establishment. It is generally better to spend time eradicating a newly arrived exotic that might not have become a weed than to wait until a certain problem has developed (Randall 1991, Schwartz and Randall 1995, Hobbs and Humphries 1995, Reichard and Hamilton 1997, Reichard 1997). Early detection and prevention are the best way to avoid huge sinks of financial and human resources in the long term (Figure 4).

Many survey forms were returned with success stories of early detection and containment (see section on responses from southeastern coastal biome, for an example). While the cost of controlling invasions may initially be more expensive than doing nothing, the long-term benefits of early action far outweigh the costs, as illustrated in Figures 4a and 4b.

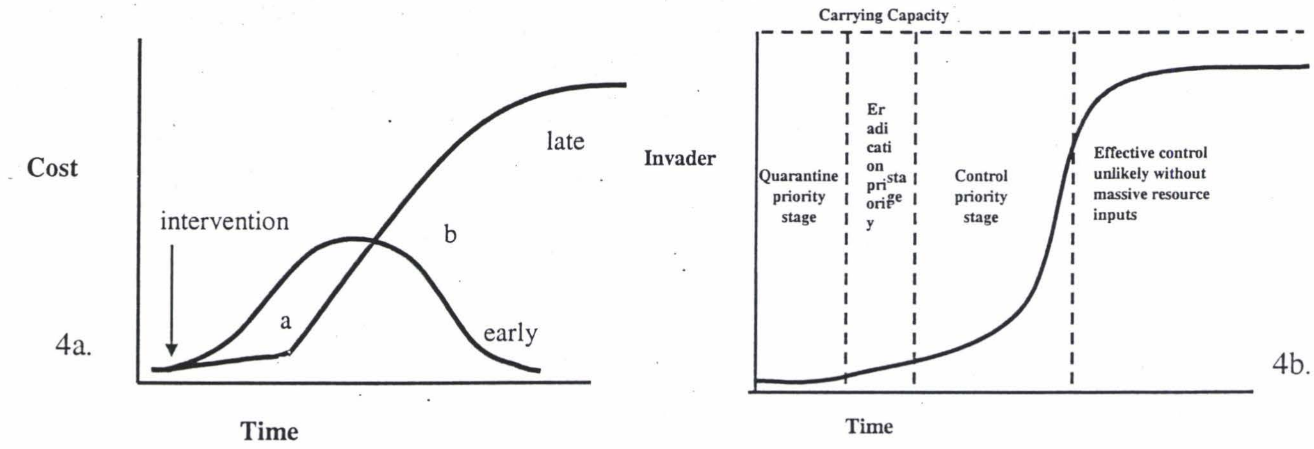


Figure 4a. Social cost of a plant invasion (incorporating the costs of damage due to the invasion and the costs of control) in relation to timing of intervention (early versus late). Costs of early expenditure (area a) and the resulting benefit (area b). 4b. Phases of weed invasion and priorities for action at each phase. Ease of treatment of an invasion problem declines from left to right (from Hobbs and Humphries 1995).

Education and training

To prevent, or at least minimize, further spread of exotics in protected natural areas, awareness of the problem must increase substantially. This will rely heavily on public education, and training agency personnel to recognize exotics early (Krummerow 1992, Asher and Harmon 1995, Marion et al. 1996, Marcus et al. 1998). Additionally, increasing the general public's awareness of the problem is an important step. Several Wilderness areas depend on casual observation and reports by non-staffers for detection of weeds. Asher and Harmon (1995) outlined 5 strategies, including incorporating weed awareness into the "Leave No Trace" mentality. In fact, with funding from state and federal agencies, Forest Service personnel at the Lolo National Forest in Montana have developed a "Leave No Weeds" campaign directed at

Principles of Leave No Weeds
- Be aware and prepare
- Pull it out, pack it out
- Camp and travel in weed free areas
- Report it

elementary school students (A. Kulla and T. Diamond, Lolo National Forest, pers. comm.).

Botanists and volunteers on the Tahoe National Forest in California produced a weed identification manual that is specific to the Granite Chief Wilderness area. The small manual explains why weeds are a problem, how to avoid spreading weeds, and how to identify weeds that are found in the Wilderness. The Bitterroot National Forest in Montana has an Adopt-a-Trail program, in which local groups take responsibility for pulling weeds along certain trails. The Nez Perce National Forest works with user groups for early detection of weeds in the Frank Church-River of No Return Wilderness. These kinds of educational efforts should be encouraged (and funded).

An effective approach is to provide weed identification training agency personnel who visit remote parts of Wilderness areas. Many survey respondents pointed out that there is little to no funding at this time for weed monitoring or inventories, and that data is collected opportunistically while other work was being conducted. The Selway-Bitterroot, Absaroka-Beartooth, Glacier National Park, and other Wilderness areas provide weed identification training for backcountry rangers, and carefully document weed populations in the back country (Appendix III). This is a time and cost effective strategy for obtaining data on remote locations (Krummerow 1992, Marcus et al. 1998).

The FC-RONR completed a remote sensing project intended to locate leafy spurge, spotted knapweed, yellow star-thistle and rush skeletonweed (the literature review and summary reports (Lachowski and Varner 1996, Lake et al. 1997a,b) resulting from this project can be obtained by contacting the Remote Sensing Applications Center, 2222 W. 2300 South, Salt Lake City, UT 84119, (801) 975-3660). The intended use for the remote sensing was to catch infestations early, however it proved most useful for detecting large infestations while missing less dense areas. The investigators determined that collecting aerial imagery for all species at once was not adequate to capture the optimum phenology of all four plants. They emphasize the need to match the flight period to plant phenology.

Prioritization of exotics

All exotic plants do not have the same level or type of impact. Some species are restricted to very disturbed areas. Others may move into undisturbed communities, but do not dominate or displace members of the native assemblages. Still other exotic plants are important food crops, and it is unrealistic to think that the current population of North America could be supported without those plants. Furthermore, several studies have found that relatively few exotic species become weeds (Loope 1992, Moyle and Light 1996a,b, Heibert 1997). Since management actions are severely limited by funding and the problem of controlling weeds is very complex, managers cannot be expected to give equal attention to all exotics. Therefore weeds need to be prioritized for control so that concrete, feasible goals can be identified (Heibert 1997).

Overall, only 6% of responding Wilderness areas reported using some system to rank exotic plants for priority. Of the National Parks Wilderness areas, almost 30% use a ranking system to prioritize exotics. The National Park Service developed a generalized ranking system for exotic plants in 1993 (Hiebert and Stubbendieck 1993, Hiebert 1997). The system ranks each species in terms of 1) significance of impact, 2) feasibility of control, and 3) urgency of action. These should be considered in combination with the amount of habitat that is susceptible. The purpose of the ranking system is to separate real threats from benign species, so efforts can be directed most effectively. Wilderness area managers may want to become familiar with the National Park System ranking system, and adapt some form for use in the lands they manage.

Communication

Awareness and communication are key in avoiding mistakes of others and detecting problem species early. For example, respondents for Wilderness areas in Alaska and Montana reported the presence of ox-eye daisy (*Chrysanthemum leucanthemum*), and salt cedar (*Tamarix ramosissima*), respectively, and indicated that these plants were not a threat to the native flora. However, both of these plants have been reported elsewhere as serious pests.

One of the most important tools of weed management is information exchange. It is important to know which plants are likely to become problematic and what to do about it once they have established. As previously mentioned, the best predictor of whether a plant will become invasive is whether it has invaded in other areas (D'Antonio et al. 1994, Reichard 1997). This accounts for a significant portion of a species' ranking in the Park Service system (Appendix II, Item I.B.9). Communication and access to centralized information can clearly keep managers informed of which species are likely to cause problems.

The database compiled from the results of this survey is accessible over the Internet (www.umt.edu/biology/leopold) for Wilderness area managers and other interested parties. The database can be queried by species (to see which Wilderness areas reported it), by Wilderness area name (to find out what species were reported). Ideally, access to information on which species are problems, which control methods have been used, and contact information, will help managers identify priorities for control.

Intentional introduction of exotics

Researchers have estimated that 99% of all exotic plants in North America were introduced intentionally (Reichard 1997, OTA 1993). Japanese honeysuckle, Russian olive, purple loosestrife, kudzu and tree-of-heaven are a few examples of plants that were introduced intentionally and are now widespread problems for land managers. Surprisingly, agencies continue to introduce non-native species for erosion control or wildlife forage. In many cases, exotics that are known to be aggressive are used (see above section on Arkansas and Alabama Wilderness areas for some examples). While most Wilderness areas are not actively seeding any plants within the Wilderness boundaries, exotics can and do spread across such political boundaries.

In a 1997 survey of Montana Forest Service Ranger Districts, Lessica and Miles (1998) found that over 80% of total area revegetated in Forest Service projects completed in 1994-96 used non-native (or predominately non-native) species. Some of the plant species used are considered highly aggressive, including smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), orchard grass (*Dactylis glomerata*) and yellow sweet clover (*Melilotus officinalis*). Collectively, these species were seeded on 1529 acres in 1994-96 (Lesica and Miles 1998).

Many exotic plants used for revegetation projects do not appear to be invasive. However it is important to consider that 1) many species seem benign at first and subsequently "explode" after an initial lag phase, and 2) such revegetation projects are a chance to promote native species. Species that we plant now for immediate benefits may become serious problems in the future. Revegetation projects near Wilderness areas should especially stay away from non-native species.

Consideration of appropriate weed controls

Clearly, the best control is prevention. Once an exotic has been introduced, appropriate action must follow quickly. In Wilderness management, the concept of "minimum tool" is prevalent. That is, agencies should use the tool that has the least impact while still fixing the problem. The minimum tool may vary depending on the extent of exotic plant establishment. Herbicides, biological control agents, and hand pulling campaigns, were all reported in the survey. Traditional opposition to chemical use may support biological control agents, but small amount of herbicides early may be better than releasing additional non-indigenous species later (Howarth 1991, Randall 1991, Asher and Harmon 1995). In addition to the problem of bringing new exotics into Wilderness areas, biological controls are often not effective for small populations of weeds, nor are they intended to eradicate weeds. Biocontrols are a part of an integrated management plan for controlling widely established species, with the intention of keeping them in check, rather than eradicating them from the new range (DeLoach 1997).

Research is needed to provide better insight to the impacts of biological control agents on non-target species. While some researchers maintain that biocontrols are ecologically harmless (DeLoach 1997), there is a lack of long-term data to support this (Simberloff and Stiling 1996).

Research needs

The general lack of information in most Wilderness areas suggests that basic surveying and monitoring should be prioritized. Many Wilderness areas have successful monitoring and data management programs; perhaps general guidelines could be agreed upon for what kind of information to collect, how often to collect it, and how to store it.

The Nature Conservancy has identified early detection and action as one of their biggest needs in their battle against weeds (Randall 1991). Part of their response is to maintain stewardship abstracts and a regularly updated database on weeds in their preserve system, as well as making information on new invaders available to their preserve managers. Government agencies should follow their example and promote awareness and communication on this issue. Unfortunately this often means mandates for data submission into large, federal databases. Perhaps smaller regional databases adhering to certain guidelines would be easier and more helpful for those involved in exotic plant management.

Wilderness areas are high priority areas for weed control, and rigorous monitoring should accompany control efforts. Monitoring is an overlooked but important part of research which contributes to our knowledge of effective management, which must be based on science to be effective. Very few of the respondents in this survey where able to determine objectively whether their control efforts were effective, because monitoring is rarely funded. Morrison (1997) points out that there is a common misconception that "monitoring is something different from research, and as such, requires less rigor in its design and implementation." Monitoring is necessary to detect changes from a current state, or following a treatment (e.g. plant removal, herbicide treatment, population response to prescribed burns, and so on) and should be designed as rigorously as a controlled experiment (Huenneke 1995, Morrison 1997). This is clearly an area where academic ecologists and those directly involved in management plans can collaborate on exotic plant issues.

Cole and Landres (1996) considered the important question of how to restore natural disturbance regimes if this increases the chance of surrounding aliens establishing. The reintroduction of fire to natural areas in the Rocky Mountains, an ecosystem adapted to fire, may have large positive effect on the spread of weeds. Several respondents mentioned concern over this possibility. The FC-RONR Wilderness has initiated a long term study of weed populations in prescribed burn areas, but no other Wilderness areas reported such projects.

The phenomenon of biological invasion itself is poorly understood. Researchers have addressed characteristics of invading successful invaders (Williamson and Fitter 1996, Mack 1996, Rejmanek 1996, Rejmanek and Richardson 1996, Reichard and Hamilton 1997) as well as abiotic factors limiting invasion (Moyle and Light 1996a,b). Less attention has focussed on community and biota level processes that influence plant invasions (Vermeij 1991, Lodge 1993). Research which furthers our understanding of each of these aspects of the invasion process can only improve our ability to prevent and control further disruption by exotic plant invasions.

Finally, it is clear that we do not understand all of the ecological effects of plant invasions. There are several well documented examples of significant ecological changes resulting from exotic plant invasions (increased soil nitrogen input, decreased fire intervals, altered phosphorus cycling, loss of species diversity, and so on) but many more remain to be elucidated. This is an active area of research, with endless possibilities for investigating interactions between plants and an environment in which they did not evolve. Most of the plants that have been introduced can not be eradicated, and we need to understand the ecological impacts of these species.

Conclusion

Exotic plant invasions are human mediated phenomena. They contribute to blurring the regional distinctiveness of the planet and the homogenization of life on earth, and are increasingly considered an important factor of human-caused global change. Biological invasions have been lamented as an environmental problem and threat to conservation for many decades, yet invasions are progressing into our last remaining public refuges. As places set aside for protection of native species and to preserve research opportunities for natural ecological processes, Wilderness areas should be high priority for prevention of exotic plant invasion.

This survey has indicated that exotic weeds are increasingly invading Wilderness areas. Most Wilderness areas are not aware of having a big weed problem now, and therefore it is important to emphasize prevention and early detection. However, 70% of responding Wilderness area do not monitor for exotic plants, and several had no information at all on exotic plant distribution. Thus, to some extent the real status is still unknown. Even though 15% of Wildernesses ranked weeds as a top priority, most management units cited lack of funds and staff to deal with weed issues, and many reported that they could not confidently assess the situation.

Almost all of the information compiled in this survey is anecdotal. This illustrates the need for standardized data collection, or at for least common objectives across agencies for Wilderness areas. Increased funding, awareness and training, and regular monitoring and treatment at trailheads would be helpful starting points.

Most importantly, prevention, early detection and rapid response are necessary to deal with this problem, and exotic plants should be a top priority for wilderness management. Exotic plants do no necessarily require a large disturbance to spread, and managers should not assume that exotic species are absent from Wilderness areas in general. The database and findings of the survey can be used to promote awareness of the issue, help prioritize areas and species for attention, and facilitate communication and discussion of weeds in our Wilderness areas.

Since Wilderness areas are supposed to be uninfluenced by people, it is easy to forget that they are managed lands. It may seem a paradox that failure to act can degrade Wilderness by allowing exotics to establish and spread. Since invasions are human caused, irreversible, and have impacts on our native communities and ecosystems which we do not understand, their presence in Wilderness areas deserves increased attention.

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Appendix I.
Survey form

Suggested changes to the survey

Wilderness Area Exotic Plant Survey
Aldo Leopold Wilderness Research Institute, 1997-98

This survey is designed to document to occurrence of exotic plants in our federal wilderness areas. While we are focusing on weeds (plants that interfere with management goals, pose a threat to the native flora, and/or are on your state's noxious weed list), please include as many non natives as possible- even if they are not perceived as a threat. Thanks for your participation.

Return this survey to Marilyn Marler, Division of Biological Sciences, University of Montana, Missoula, MT 59812

Name____

Address____

Phone, email_________________________ Name of wilderness area____________________

Species list. Please indicate abundance (1= trace, 5= widely established), possible threat to management goals (1= negligible, 3= severe), and what control projects, if any, are underway for the plant. Attach additional pages if needed.

Latin name	abundance 1-5	threat 1-3	Controls/ research projects

1. Please describe as specifically as possible the geographic area to which the list pertains. Enclose a map if possible.

____

____

2. Circle the number that you feel best describes the nature of the species list.

1(the list is rough) 2 3 4 5 (the list is highly detailed)

3. For this area, exotic plants are
   - A) not much of a problem. Please explain: ____
   - B) one of many small problems
   - C) significant; one of the top 10 management concerns
   - D) very important; one of 2 or 3 top priorities

4. Is there a written weed management plan for this wilderness area? Y N

   If there **is** a plan, does it prioritize weeds for control? Y N

   If there **is no plan**, why not? A) weeds aren't a significant problem B) it is cost prohibitive C) it is labor prohibitive D) other:

5. Are weeds monitored in the wilderness area? Y N

continue on back

6. In general, what is the source of the data you are providing: a) casual or opportunistic observation
b) systematic sampling (along transects, in long term plots, etc.)
c) best guess, based on knowledge of surrounding, similar areas
d) other:____

We'd appreciate more detailed information on plants that are of greatest concern. Please respond to the following for your most serious weeds. Leave any item blank if information is lacking.

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

We'd also like to receive general impressions of the status of exotic plants in this wilderness area, and any relevant background information (grazing history, elevation tolerance of species, etc) that you may have access to. Feel free to expand on any of your responses. Thanks very much for your time.

6. In general, what is the source of the data you are providing: a) casual or opportunistic observation
b) systematic sampling (along transects, in long term plots, etc.)
c) best guess, based on knowledge of surrounding, similar areas
d) other:____

We'd appreciate more detailed information on plants that are of greatest concern. Please respond to the following for your most serious weeds. Leave any item blank if information is lacking.

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
c) one or more large populations and few to several small populations
d) infestations mainly along roads, rivers, trails, etc. e) infestations are just outside wilderness area

The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
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The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

Name ______________________

What disturbance regime may be responsible for establishment or spread of this weed?______________________________

Pattern of infestation (circle one)
a) one or more large populations b) few or several small populations
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The weed is a) increasing despite control efforts b) increasing; there are no control efforts
c) decreasing though control efforts d) decreasing without control efforts e) stable

We'd also like to receive general impressions of the status of exotic plants in this wilderness area, and any relevant background information (grazing history, elevation tolerance of species, etc) that you may have access to. Feel free to expand on any of your responses. Thanks very much for your time.

Suggested changes

Future surveys should address problem plants only. The varying background of survey respondents resulted in a disparity in the kinds and number of plants that were reported. For example, most people did not mention dandelions, shepherd's purse, or clovers, although it is very likely that these species are present in most Wilderness areas. Some exotics are fairly benign, and although they are evidence of human impacts to natural areas (Marion et al. 1986), attention must be given to those plants that pose a real threat to native communities and ecosystems.

Question 3 is unclear, and it is difficult to interpret responses consistently. For example, some people ranked exotic plants as "a top priority" because they were trying to prevent weed establishment, while others meant that there were already well developed problems. This question should be clarified.

The subjective categorical ranking for abundance (1-5) should be replaced with coverage estimates. For example (1)less than 5 acres, (2)5-100 acres, (3) 100-500 acres, (4)500-1000 acres, (5) >1000 acres. This will eliminate some of the subjectivity, and provide data that allows coverage estimates of species nationally in Wilderness areas.

Future surveys should also request more specific information on control efforts. Instead of having a space to list control efforts, respondents should "check a box" if they use mechanical, biological or chemical controls, with space for specific information on the name brand of herbicides, species of biocontrol agents, time interval of handpulling efforts, and so on. Respondents did not always offer this kind of information. This would lengthen the survey considerably, but the information is very important.

Respondents should also indicate whether they are responding for the Wilderness area only, or for adjacent lands.

Example organization scheme for future surveys. Questions from the 1997-98 form could be incorporated into this format.

Latin name	**Common name**	**Abundance** a) <5 acres b) 5-100 acres c) 100-500 acres d) 500-1000 acres e) >1000 acres f) no idea	**threat**	**Mechanical controls** List type (e.g. mowing, pulling) and approx. frequency	**Biological controls** Give name or description of the agent used	**Chemical controls** Give the brand name (eg Tordon, RoundUp)
C. maculosa	Spotted knapweed	b	3	Handpulling 2x each summer		Tordon

Appendix II.
Exotic plant species reported for each biome.

Biomes are arranged geographically (west to east) and species are listed alphabetically by family.

Tundra/ Boreal Forest

Family	Species	common name	Areas reporting
Asteraceae	*Chrysanthemum leucanthemum*	ox eye daisy	Denali, Togiak
	Cirsium vulgare	bull thistle	Izembek
	Crepis tectorum	hawksbeard	Togiak
	Heiracium scabriusculum	orange hawkweed	Denali
	Leucanthemum vulgare	oxe eye daisy	Togiak
	Matricaria discoidea	pineapple weed	Togiak
	Matricaria maritima	mayweed	Togiak
	Matricaria matricariodes	pineappleweed	Denali
	Taraxacum officinale	dandelion	Denali, Togiak
Brassicaceae	*Brassica juncea*		Togiak
	Capsella bursa-pastoris	shepard's purse	Togiak
	Lepidium densifolium	lepidium	Denali
Caryophyllaceae	*Stellaria media*	chickweed	Togiak
Chenopodiaceae	*Chenopodium album*	goosefoot	Denali
Fabaceae	*Melilotus alba*	white sweetclover	Denali
	Trifolium hybridum	clover	Togiak
	Trifolium pratense	clover	Denali
	Trifolium repens	clover	Denali, Togiak
	Vicia cracca	vetch	Denali
Papaveraceae	*Papaver nudicaule*		Togiak
Plantaginaceae	*Plantago major*	plaintain	Denali, Togiak
Poaceae	*Alopecurus pratensis*	meadow fox tail	Togiak
	Hordeum bracyantherum		Togiak
	Hordeum jubatum	fox-tail barley	Denali, Togiak
Polygonaceae	*Phleum pratense*	timothy	Togiak
	Rumex acetosella	dock	Togiak

Pacific coastal/ Cascadian forest

Family	Species	common name	Areas reporting
Amaranthaceae	*Amaranthus spp*	amaranth	Alpine Lakes
Apiaceae	*Hedera helix*	English ivy	Olympic
Apiaceae	*Heracleum mantegazzianum*	giant hogweed	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Noisy-Diobsud, Norse Peak
Asteraceae	*Arctium minus*	burdock	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Noisy-Diobsud, Norse Peak
	Centaurea diffusa	diffuse knapweed	Alpine Lakes, Lake Chelan-Sawtooth
	Centaurea maculosa	spotted knapweed	Alpine Lakes, Boulder River, Clearwater Glacier Peak, Henry M. Jackson Noisy-Diobsud, Norse Peak, Three Sisters
	Centaurea pratensis	meadow knapweed	Alpine Lakes, Boulder River, Clearwater Glacier Peak, Henry M. Jackson, Noisy-Diobsud Norse Peak
	Centaurea solstitialis	yellow star thistle	Snow Mountain, Yolla Bolly
	Centaurea spp	knapweeds	Black Canyon
	Chrysanthemum leucanthemum	oxe eye daisy	Alpine Lakes, Boulder River, Clearwater, Henry M. Jackson, Middle Santiam, Noisy-Diobsud, Norse Peak, Olympic, Table Rock
	Cirsium arvense	canada thistle	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Little Sink

			ACEC, Middle Santiam, Noisy Diobsud, Norse Peak, Table Rock
	Cirsium vulgare	bull thistle	Alpine Lakes, Black Canyon, Little Sink ACEC, Olympic, Snow Mountain
	Crupina vulgaris	common crupina	Lake Chelan-Sawtooth, Yolla Bolly
	Hypochaeris glabra	smooth cat's ear	Middle Santiam
	Hypochaeris radicata		Oregon Islands
	Lactuca muralis	wall lettuce	Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Middle Santiam, Noisy-Diobsud, Norse Peak, Table Rock
	Lactuca serriola	lettuce	Alpine Lakes
	Lavatera arborea	sow thistle	Farallon
	Madia spp	tarweed	Alpine Lakes
	Senecio jacobaea	tansy ragwort	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Little Sink ACEC, Middle Santiam, Noisy-Diobsud, Norse Peak, Olympic, Oregon Islands, Table Rock
	Silybum marianum	milk thistle	Oregon Islands
	Sonchus oleraceus		Oregon Islands
	Tanacetum vulgare	tansy	Alpine Lakes
	Taraxacum officinale	dandelion	Alpine Lakes, Olympic
	Tragopogon dubius	salsify	Alpine Lakes
	Tragopogon dubius	salsify	Alpine Lakes
Berberidaceae	*Ilex aquifolium*	english holly	Olympic
Boraginaceae	*Cynoglossum officinale*	houndstongue	Alpine Lakes
Brassicaceae	*Cakile edentula*	american sea rocket	Olympic
	Capsella bursa-partoris	shepard's purse	Snow Mountain
	Capsella bursa-partoris	shepard's purse	Yolla Bolly
	Lepidium spp	pepperweed	Alpine Lakes
Caryophyllaceae	*Cerastium fontanum*	common chickweed	Olympic
	Cerastium glomeratum	sticky chickweed	Olympic
	Gysophila paniculata	baby's breath	Alpine Lakes
	Stellaria graminea	chickweed	Olympic
Chenopodiaceae	*Tetragonia tetragonoides*	New Zealand spinach	Farallon
Convulvulaceae	*Calystegia sepium*	wild morning glory	Olympic
Dipsacaceae	*Dipsacus sylvestris*	teasel	Black Canyon
Fabaceae	*Cystisus scoparius*	scotch broom	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Little Sink ACEC, Noisy-Diobsud, Olympic
	Lathyrus sylvestris	small everlasting peavine	Olympic, Norse Peak
	Melilotus alba	sweet clover	Alpine Lakes
	Trifolium repens	clover	Alpine Lakes
Hypericaceae	*Hypericum perforatum*	St Johnswort	Alpine Lakes, Boulder River, Clearwater, Glacier Peak, Henry M. Jackson, Little Sink ACEC, Middle Santiam, Noisy-Diobsud, Norse Peak, Olympic
	Hypericum calycinum	Jerusalem star	Olympic
Iridaceae	*Iris psuedacorus*	Yellow iris	Olympic
Juncaceae	*Juncus conglomeratus*	conglomerate rush	Olympic
Lamiaceae	*Prunella vulgaris*	self heal	Alpine Lakes, Olympic
Malvaceae	*Malva neglecta*	mallow	Alpine Lakes, Farallon
Nymphaceae	*Nymphaea odorata*	fragrant water lily	Olympic
Pinaceae	*Pinus ponderosa*	ponderosa pine	Olympic
Plantaginaceae	*Plantago coronopus*	plantain	Farallon
	Plantago lanceolata	plantain	Alpine Lakes
	Plantago major	plantain	Alpine Lakes
Poaceae	*Agropyron repens*	quackgrass	Olympic
	Agrostis capillaris	colonial bentgrass	Olympic
	Agrostis stolonifera	redtop	Olympic
	Anthoxanthum odoratum	sweet vernal grass	Olympic

	Avena barbata	wild oats	Snow Mountain
	Avena barbata	wild oats	Yolla Bolly
	Bromus mollis	soft chess	Snow Mountain, Yolla Bolly
	Bromus tectorum	cheatgrass	Black Canyon, Olympic, Snow Mountain
	Dactylis glomerata	orchard grass	Olympic
	Elymus caput-medusae	medusahead	Snow Mountain, Yolla Bolly
	Hordeum hystrix	barley	Snow Mountain, Yolla Bolly
	Hordeum leporinum	barley	Snow Mountain, Yolla Bolly
	Lolium perenne	perennial rye	Snow Mountain, Yolla Bolly
	Phalaris arundinacea	reed canarygrass	Olympic
	Phleum pratense	timothy grass	Alpine Lakes, Black Canyon, Snow Mountain
	Poa annua		Oregon Islands, Yolla Bolly
	Poa bulbosa		Alpine Lakes
	Poa pratense	Kentucky bluegrass	Black Canyon, Olympic
	Ventenata dubia	ventenata	Black Canyon
	Vulpia myuros		Snow Mountain, Yolla Bolly
Polygonaceae	*Polygonum aviculare*	knotweed	Alpine Lakes
	Polygonum cuspidatum	japanese knotweed	Alpine Lakes, Boulder River, Clearwater, Glacier Peak,
	Rumex acetosella		Oregon Islands, Middle Santiam, Alpine Lakes
	Rumex crispsus	curly dock	Alpine Lakes, Olympic
	Polygonum cuspidatum	Japanese knotweed	Olympic
	Rumex obtusifolius	bitter dock	Olympic
	Polygonum sachalinese	Giant knotweed	Olympic
Ranunculaceae	*Ranunculus repens*		Alpine Lakes
Rosaceae	*Potentilla recta*	sulfur cinquefoil	Alpine Lakes
	Rubus discolor	Himalayan blackberry	Middle Santiam
	Rubus laciniatus		Alpine Lakes
	Prunus laurocerasus	laurel cherry	Olympic
	Sorbus aucuparia	european mountain ash	Olympic
Rubiaceae	*Galium odoratum*	bedstraw	Olympic
Scrophulariaceae	*Digitalis purpureum*	digitalis, foxglove	Alpine Lakes, Olympic
	Linaria dalmatica	dalmation toadflax	Alpine Lakes
	Verbacum thapsus	mullein	Alpine Lakes

California mediterranean

Family	**Species**	**common name**	**Areas reporting**
Amaryllidaceae	*Brunsvigia rosea*	Naked ladies	Phillip Burton
Apiaceae	*Conium maculatum*	Poison hemlock	Phillip Burton
	Foeniculum vulgare	fennel	Phillip Burton
Apocynaceae	*Vinca major*	Periwinkle	Phillip Burton, Silver Peak, Ventana
Aquifoliaceae	*Ilex aquifolium*	english holly	Phillip Burton
Araliaceae	*Hedera helix*	english ivy	Phillip Burton
Asteraceae	*Arctotheca calendula*	capeweed	Phillip Burton
	Carduus acanthoides	giant plumeless thistle	Phillip Burton
	Cynara cardunculus	cardoon	San Mateo
	Centaurea melitnsis	field knapweed	San Mateo
	Centaurea solstitialis	yellow star-thistle	Dick Smith, Garcia, Machesna, Matilija Phillip Burton, San Rafael, Santa Lucia, Sespe, Silver Peak, Ventana
	Cirsium vulgare	bull thistle	Phillip Burton
	Erechites glomerata	fire weed, cut-leaved	Phillip Burton
	Erechites minima	fire weed	Phillip Burton
	Leucanthemum vulgare	ox-eye daisy	Phillip Burton
	Senecio mikanoides	goldenrod	Silver Peak, Ventana
	Silybum marianum	Milk thistle	Phillip Burton
	Sonchus sp.	Sow thistle	Phillip Burton

	Taraxacum officinale	dandelion	Caribou
Boraginaceae	*Myosotis latifolia*	forget-me-not	Phillip Burton
Euphorbiaaceae	*Euphorbia oblongata*	oblong spurge	Phillip Burton
Euphorbiaceae	*Euphorbia lathris*	gopher plant	Phillip Burton
Fabaceae	*Cytisus scoparius*	Scotch thistle	Phillip Burton
	Genista monspessulana	french broom	Phillip Burton, Silver Peak, Ventana
	Lathyrus latifolius	perennial pea	Phillip Burton
	Ulex europaeus	gorse	Phillip Burton
Geraniaceae	*Erodium cicutarium*	filaree, storksbill	Chumash, Dick Smith, Sespe
Iridaceae	*Crocosmia crocosmiiflora*	Mt. Brecia	Phillip Burton
Myrtaceae	*Eucalyptus globulus*	eucalyptus	Phillip Burton
Pinaceae	*Pinus radiata*	Monterey pine	Phillip Burton
Poaceae	*Ammophila arenaria*	European beachgrass	Phillip Burton
	Arundo donax	giant cane	Matilija
	Avena spp	wild oats	Dick Smith, Matilija, Sespe
	Bromus madritensis		Chumash, Dick Smith, Sespe
	Bromus rigidus		Dick Smith
	Bromus spp	annual bromes	Matilija
	Bromus spp	annual bromes	Sespe
	Bromus tectorum	cheatgrass	Chumash, Dick Smith, Sespe
	Cortadera jubata	pampas grass	Phillip Burton, Silver Peak, Ventana
	Poa pratensis	kentucky bluegrass	Caribou
Pontederiaceae	*Eichhornia crassipes*	Water hyacinth	Phillip Burton
Rosaceae	*Cotoneaster sp.*	cotoneaster	Phillip Burton
Scrophulariaceae	*Digitalis purpurea*	foxglove	Phillip Burton
Tamaricaceae	*Tamarix ramosissima*	tamarisk	Agua Tibia, Hauser, Pine Creek, San Mateo
	Tamarix spp	salt cedar	Dick Smith, San Rafael, Sespe

California montane

Family	**Species**	**common name**	**Areas reporting**
Apiaceae	*Torilis nodosa*	torilis	Sequoia- Kings Canyon
Asteraceae	*Carduus spp*	thistles	Domeland, Golden Trout, Jennie Lake, Kiavah, Monarch, South Sierra
	Centaurea maculosa	spotted knapweed	Yosemite
	Centaurea solstitialis	yellow starthistle	Ansel Adams, Dinkey Lakes, Domeland, Golden Trout, Ishi, Jennie Lake, John Muir, Kaiser, Kiavah, Monarch, South Sierra, Yosemite
	Cirsium spp	thistles	Domeland, Golden Trout, Jennie Lake, Kiavah Monarch, South Sierra
	Cirsium vulgare	bull thistle	Sequoia- Kings Canyon, Yosemite, Ansel Adams
	Hypochoeris glabra	cats-ear	Sequoia- Kings Canyon
	Sonchus tenerrimus	milk thistle	Sequoia- Kings Canyon
	Taracum officinale	dandelion	Ansel Adams, Dinkey Lakes, John Muir, Kaiser, Sequoia-Kings Canyon, Thousand Lakes
	Onopordum acanthium	scotch thistle	South Warner
Boraginaceae	*Cynoglossum officinale*	hound's tongue	Thousand Lakes
Brassicaceae	*Sisymbrium officinale*	tumble mustard	Sequoia- Kings Canyon
Caryophyllaceae	*Cerastium glomeratum*		Sequoia- Kings Canyon

	Silene gallica		Sequoia- Kings Canyon
	Stellaria media	chickweed	Sequoia- Kings Canyon
Fabaceae	*Medicago polymorpha*	alfalfa	Sequoia- Kings Canyon
	Robinia pseudoacacia	black locust	Yosemite
	Trifolium campestre	clover	Sequoia- Kings Canyon
	Trifolium repens	clover	Sequoia- Kings Canyon, Thousand Lakes
Geraniaceae	*Erodium cicutarium*	storksbill	Sequoia- Kings Canyon
Hypericaceae	*Hypericum perforatum*	St Johnswort	Ishi, Yosemite
Iridaceae	*Iris missouriensis*	iris	John Muir, Golden Trout, South Sierra
Plantagoaceae	*Plantago lanceolata*	plantain	Sequoia- Kings Canyon
Poaceae	*Avena fatua*	wild oats	Sequoia- Kings Canyon
	Bromus arenarius		Sequoia- Kings Canyon
	Bromus diandrus		Ansel Adams, Dinkey Lakes, John Muir, Kaiser, Monarch, Sequoia-Kings Canyon
	Bromus hordeaceous		Sequoia- Kings Canyon
	Bromus madritensis		Sequoia- Kings Canyon
	Bromus madritensis ssp. Rubens		Ansel Adams, Dinkey Lakes, John Muir, Kaiser
	Bromus madritensis ssp. Rubens		Monarch
	Bromus species	brome grasses	Yosemite
	Bromus tectorum	cheatgrass	Ansel Adams, Dinkey Lakes, Golden Trout, Granite Chief, John Muir, Kaiser, Monarch, Sequoia-Kings Canyon, South Sierra, Granite Chief
	Poa annua		Sequoia- Kings Canyon
	Poa bulbosa		Granite Chief
	Poa palustris		Sequoia- Kings Canyon
	Poa pratensis	kentucky bluegrass	Sequoia- Kings Canyon, Thousand Lakes
	Polypogon monspeliensis	rabbitfoot grass	Sequoia- Kings Canyon
	Sorghum halepense	Johnson grass	Yosemite
	Vulpia bromoides		Sequoia- Kings Canyon
	Vulpia myuros		Ansel Adams, Dinkey Lakes, John Muir, Kaiser, Monarch, Sequoia-Kings Canyon
Polygonaceae	*Rumex acetosella*	dock	Sequoia- Kings Canyon
	Rumex crispus	dock	Sequoia- Kings Canyon
Rosaceae	*Rubus discolor*	himalayan blackberry	Yosemite
Rubiaceae	*Galium parisinse*	bedstraw	Sequoia- Kings Canyon
Scrophulariaceae	*Arrhenatherum elatius*		Sequoia- Kings Canyon
	Verbascum thapsus	mullein	Granite Chief, Sequoia-Kings Canyon, Yosemite
	Veronica arvenses	speedwell	Sequoia- Kings Canyon
	Veronica serpyllifolia	speedwell	Sequoia- Kings Canyon
Simaroubiaceae	*Ailanthus altissima*	tree-of-heaven	Domeland, Yosemite

Intermountain deserts, steppe, forest

Family	**Species**	**common name**	**Areas reporting**
Apocynaceae	*Nerium oleander*	oleander	Lake Mead
Arecaceae	*Phoenix dactylifera*	palm	Lake Mead
	Washingtonia filifera	fan palm	Lake Mead
Asteraceae	*Carduus nutans*	musk thistle	Gearhart Mountain
	Centaurea diffusa	diffuse knapweed	Gearhart Mountain
	Centaurea maculosa	spotted knapweed	Gearhart Mountain, Malheur Resource Area, Mount Moriah,
	Centaurea repens (syn *Acroptilon r.)*	russian knapweed	Jordan and Malheur Resource Areas, Quinn Canyon

	Centaurea solstitialis	yellow star thistle	Bridge Creek, Jordan Resource Area
	Cirsium arvense	canada thsitle	Gearhart Mountain, Bridge Creek, Ruby Mountains
	Cirsium vulgare	bull thistle	Bridge Creek
	Onopordum acanthium	scotch thistle	Mount Moriah, Malhuer Reseource Area
Brassicaceae	*Cardaria draba*	white top	Malheur Resource Area
Boraginaceae	*Cynoglossum officinale*	hounds tongue	Bridge Creek
Dipsacaeae	*Dipsacus sylvestri*	teasel	Bridge Creek
Euphorbiaceae	*Euphorbia esula*	leafy spurge	Gearhart Mountain, Ruby Mountains
Fabaceae	*Parkinsonia aculeata*	Mexican palo verde	Lake Mead
Geraniaceae	*Erodium circutarium*	filaree	Lake Mead
Lamiaceae	*Salvia aethiopos*	mediterranean sage	Jordan Resource Area
Poaceae	*Agropyron cristatum*	crested wheatgrass	Mount Moriah
	Bromus madritensis	mediterranean brome	Lake Mead
	Bromus tectorum	cheatgrass	Gearhart Mountain, Bridge Creek, Ruby Mountains, East Humbolt, Jargridge, Quinn Canyon, Grant Range, Mount Moriah
	Phleum pratense	timothy	Bridge Creek
	Poa pratense	kentucky bluegrass	Bridge Creek, Mount Moriah
Scrophulariaceae	*Linaria dalmatica*	dalmation toadflax	Gearhart Mountain
	Linaria vulgaris	yellow toadflax	Ruby Mountains
	Verbascum thapsos	mullein	Lake Mead
Tamaricaceae	*Tamarix ramosissima*	salt cedar	Lake Mead

Mojave and Sonoran Desert

Family	**Species**	**common name**	**Areas reporting**
Aizoaceae	*Mesambryanthemum crystallinum*	iceplant	Organ Pipe Cactus
	Mesambryanthemum nodiflorum	iceplant	Organ Pipe Cactus
	Trianthema portulacastrum	horse purselane	Organ Pipe Cactus, Saguaro
Amaranthaceae	*Amaranthus albus*	amaranthus	Saguaro
Anacardiaceae	*Toxicodendron rydbergii*	poison ivy	Aravaipa Canyon
Apiaceae	*Conium maculatum*	poison hemlock	White Mountain
Asteraceae	*Sonchus oleraceus*		Pusch Ridge
	Carduus nutans	musk thistle	Aldo Leopold, Apache Kid, Capitan Mountain, Gila, White Mountain, Withington
	Carthamus tinctorius	safflower	Organ Pipe Cactus
	Centaurea maculosa	spotted knapweed	Aldo Leopold, Gila
	Centaurea melitensis	malta star-thistle	Organ Pipe Cactus, Saguaro
	Cirsium vulgare	bull thistle	Chiricahua, Galiuro, Miller Peak, Pajarita, Pusch Ridge, Rincon Mountain, Santa Teresa
	Conyza canadensis var. glabrata	conyza	Organ Pipe Cactus
	Conyza coulteri	conyza	Organ Pipe Cactus
	Dimorphotheca sinuata		Pusch Ridge, Saguaro
	Eclipta prostrata	false daisy	Organ Pipe Cactus
	Heterotheca subaxillaris		Saguaro
	Lactuca serriola	prickly lettuce	Organ Pipe Cactus, Pusch Ridge, Saguaro
	Onopordum acanthium	scotch thistle	Aldo Leopold, Cebolla, Gila Mount Logan, Mount Trumball
	Sonchus asper	spiny sow thistle	Organ Pipe Cactus
	Sonchus asper	sow thistle	Pusch Ridge, Saguaro
	Sonchus oleraceus		Saguaro
	Taraxacum laevigatum		Saguaro
	Verbesina encelioides		Saguaro
	Xanthium spinosum		Upper Burro Creek
Brassicaceae	*Brassica tournefortii*	black mustard	Cabeza Prieta, Cactus Plain WSA, Eagletail

			Mountains, East Cactus Plain, Muggins Mountains, Organ Pipe Cactus, Saguaro, Tabl Top, Trigo Mountain
	Capsella bursa-pastoris	shepard's purse	Saguaro
	Descurainia sophia		Pusch Ridge, Saguaro
	Rorripa nasturtium		Arrastra Mountain, Upper Burro Creek
	Sisymbrium irio	tumble mustard	Coyote Mountains, Organ Pipe Cactus, Pusch Ridge, Saguaro, Table Top, White Canyon
	Sysimbrium orientale		Saguaro
Caryophyllaceae	*Cerastium gracile*	chickweed	Saguaro
	Herniara cinerea		Pusch Ridge
Chenopodiaceae	*Chenopodium graveolens*	goosefoot	Saguaro
	Chenopodium murale		Organ Pipe Cactus
	Salsola australis	tumbleweed	Organ Pipe Cactus, Pusch Ridge, Saguaro
	Salsola iberica		Arrastra Mountain,
	Salsola kali	Russian thistle	Mojave National Preserve, Saguaro, White Canyon
Convulvulaceae	*Convulvulus arvensis*	bindweed	Mount Logan, Mount Trumball, Saguaro
	Convulvulus arvensis	field bindweed	Sycamore Canyon, Woodchute
	Cuscuta indecora	dodder	Saguaro
	Ipomea purpura		Saguaro
Cyperacaceae	*Cyperus esculentus*		Saguaro
Dipscaceae	*Dipsacus sylvestris*	teasel	White Mountain
Elaeagnaceae	*Elaeagnus angustifolia*	russian olive	Bandelier, Paria River, Vermillion Cliffs
Euphorbiaceae	*Euphorbia esula*	leafy spurge	Aldo Leopold, Gila
Fabaceae	*Medicago polymorpha v. vulgaris*		Pusch Ridge
	Medicago satvia	alfalfa	Saguaro
	Melilotus alba	white sweet clover	Upper Burro Creek, Wabayuma, Wet Beaver
	Melilotus indicus	sweet clover	Saguaro
	Melilotus officinale	sweet clover	Arrastra Mountain, Organ Pipe Cactus, Wet Beaver
Geranciaceae	*Erodium texanum*	storksbill	Eagletail Mountains
	Erodium cicutarium	filaree	Arrastra Mountain, Aubrey Peak, Baboquivari Coyote Mountains, Mojave NP, Mount Nutt, Mount Tipton, Mount Wilson, Organ Pipe Cactus, Pusch Ridge, Saguaro, Table Top, Tre Alamos, Upper Burro Creek, Wabayuma, War Springs, White Canyon
Lamiaceae	*Marrubium vulgare*	horehound	Apache Creek, Saguaro, Sycamore Canyon, Upper Burro Creek
Linaceae	*Linum grandiflorum*	flax	Saguaro
	Linum usitassimum	common flax	Organ Pipe Cactus
Malvaceae	*Malva parviflora*	cheeseweed	Baboquivari, Organ Pipe Cactus, Saguaro
	Gossypium thurberi	desert cotton	Aravaipa Canyon
Molluginaceae	*Mollugo cereviana*		Saguaro
Moraceae	*Ficus carica*	fig	Organ Pipe Cactus
Myrtaceae	*Eucalyptus rostrata*	eucalyptus	Pusch Ridge
Poaceae	*Agrostis semiverticillata*		Saguaro
	Agrostis stolonifera		Saguaro
	Arabicus schismus		Mojave National Preserve
	Arundo donax	giant cane	Saguaro, Upper Burro Creek
	Avena fatua	wild oats	Organ Pipe Cactus, Pusch Ridge, Saguaro, White Canyon
	Bromus catharticus	Arizona brome	Organ Pipe Cactus, Saguaro, Table Top, Trigo Mountain

Bromus rubens	red brome	Saguaro, Santa Teresa, Signal Mountain, Swansea, Table Top, Trigo Mountain, Tres Alamos, Upper Burro Creek, Wabayuma, Warm Springs, Wet Beaver, White Canyon, Woolsey Peak
Bromus tectorum	cheatgrass	Arrastra Mountain, Aubrey Peak, Bandelier, Cebolla, Mojave NP, Mount Nutt, Mount Tipton, Mount Wilson, Organ Pipe Cactus, Saguaro, Tres Alamos, Upper Burro Creek, Wabayuma, Warm Springs
Cenchrus ciliaris	buffelgrass	Chiricahua, Galiuro, Miller Peak, Pajarita, Pusch Ridge, Rincon Mountain, Santa Teresa
Chloris virgata	feather fingergrass	Arrastra Mountain, Organ Pipe Cactus, Saguaro, Upper Burro Creek
Cyonodon dactylon	bermuda grass	Arrastra Mountain, Aravaipa Canyon, Organ Pipe Cactus, Pusch Ridge, Saguaro, Wabayum White Canyon, Upper Burro Creek
Dactyloctenium aegyptium	crowfoot grass	Organ Pipe Cactus
Digitaria ciliaris		Saguaro
Digitaria sanguinalis		Saguaro
Echinochloa colonum	jungle-rice, leopard grass	Organ Pipe Cactus, Pusch Ridge, Saguaro
Echinochloa crusgalii		Organ Pipe Cactus
Eragrostis cenchroides		Pusch Ridge
Eragrostis cilianensis		Organ Pipe Cactus, Pusch Ridge
Eragrostis curvula		Saguaro
Eragrostis echinochloidea		Saguaro
Eragrostis lehmanniana	lovegrass	Baboquivari, Organ Pipe Cactus, Pusch Ridge, Saguaro, Wet Beaver
Eriochloa acuminata var acuminata		Organ Pipe Cactus
Euryops multifidus	euryops	Chiricahua, Galiuro, Miller Peak, Pajarita, Pusch Ridge, Rincon Mountain, Santa Teresa
Hordeum hystrix		Arrastra Mountain, Upper Burro Creek
Hordeum glaucum	wild barley	White Canyon
Hordeum murinum	wild barley	Saguaro
Hordeum murinum ssp. Glaucum		Organ Pipe Cactus
Hordeum murinum subsp. Glaucum	barley	Pusch Ridge
Panicum antidotale		Organ Pipe Cactus
Pennisetum ciliare	buffelgrass	Organ Pipe Cactus, Pusch Ridge, Saguaro
Pennisetum setaceum	fountain grass	Chiricahua, Galiuro, Miller Peak, Organ Pipe Cactus, Pajarita, Pusch Ridge, Rincon Mountain,
Phalaris minor		Organ Pipe Cactus, Saguaro
Phleum pratense	timothy	Saguaro
Phragmites communis	reed grass	Chemhuevi Mountains, Needles Peaks
Poa annua		Organ Pipe Cactus, Pusch Ridge, Saguaro
Poa pratensis		Saguaro
Polypogon monospeliensis	Rabbit foot grass	Arrastra Mountain, Beaver Dam Mountains, Organ Pipe Cactus, Paiute, Pusch Ridge, Saguaro, Upper Burro Creek, Wabayuma, White Canyon
Polypogon viridis		Organ Pipe Cactus
Rhynchelytrum repens	natal grass	Chiricahua, Galiuro, Miller Peak, Pajarita, Pusch Ridge, Rincon Mountain, Saguaro, Sant Teresa
Schismus arabicus		Saguaro
Schismus barbatus	mediterranean grass	Cactus Plain WSA, East Catcus Plain, Muggin Mountain, New Water Mountains, Organ Pipe

			Cactus, Pusch Ridge, Saguaro, Table Top, Tri Mountian, White Canyon
	Schismus sp.		Cabeza Prieta
	Sorghum halapense		Organ Pipe Cactus, Saguaro
	Triticum aestivum		Saguaro
	Vulpia bromoides		Pusch Ridge
Polemoniaceae	*Gilia tricolor subsp. Tricolor*	gilia	Pusch Ridge
Polygonaceae	*Polygonum aviculare*		Saguaro
	Rumex acetosella		Saguaro
	Rumex crispus		Saguaro
Portulacaceae	*Portulaca oleraceae*		Organ Pipe Cactus
Punicaceae	*Punicum granatum*		Organ Pipe Cactus
Rubiaceae	*Galium aparine*	bedstraw	Pusch Ridge, Saguaro
	Hedyotis crassifolia		Saguaro
Scrophulariaceae	*Linaria dalmatica ssp dalmatica*	dalmation toadflax	Wet Beaver
	Linaria genistifolia ssp dalmatica	toadflax	Juniper Mesa
	Verbascum thapsus	mullein	Bandelier, Mount Logan, Mount Trumball
Simaroubiaceae	*Ailanthus altissima*	tree of heaven	Bandelier
Solanaceae	*Nicotiana glauca*		Pusch Ridge
	Solanum americanum		Organ Pipe Cactus
	Solanum eleagnifolium	silverleaf nightshade	Sycamore Canyon
Tamaricaceae	*Tamarix pentandra*	salt cedar	Arrastra Mountain, Bandelier, Mount Tipton, Upper Burro Creek, Wabayuma
	Tamarix ramosissima	salt cedar, tamarisk	Chiricahua
	Tamarix aphylla		Organ Pipe Cactus
	Tamarix chinensis	tamarisk	Sycamore Canyon
	Tamarix pentandra	salt cedar	Aravaipa Canyon, Hausayampa River Canyon North Maricopa, Table Top, White Canyon
	Tamarix ramosissima	salt cedar, tamarisk	Aravaipa Canyon, Beaver Dam Mountains, Cebolla, Galiuro, Miller Peak, Mojave Nation Preserve, Needles Peak, Organ Pipe Cactus, Paiute, Pajarita, Paria River, Pusch Ridge, Rawhide Mountains, Redfield Canyon, Rinco Mountain, Saguaro, Sandia Mountains, Santa Teresa, Swanasea, Vermillion Cliffs, Wet Beaver, White Canyon
	Tamarix spp	tamarisk	Fishhooks, North Santa Teresa, Redfield Canyon
Ulmaceae	*Ulmus sibericia*	siberian elm	Bandelier, Sandia Mountains
Verbenaceae	*Lantana camara*		Organ Pipe Cactus
Zygophyllaceae	*Tribulus terrestris*		Arrastra Mountain, Organ Pipe Cactus, Upper Burro Creek, Wabayuma

Rocky Mountain Montane forests

Family	**Species**	**common name**	**Areas reporting**
Asteraceae	*Arctium minus*	burdock	Absaroka Beartooth, Selway Bitterroot, Wenaha- Tucannon
	Carduus acanthoides	plumeless thistle	Maroon Bells- Snowmass
	Carduus nutans	musk thistle	Collegiate Peaks, Encampment River, Fossil Ridge, Gros Venture, High Uintas, Holy Cross, La Garita, Lee Metcalf, Lone Peak, Mt. Nebo, Mt Timpanogos, Platte River, Rocky Mountain NP, Scapegoat, Teton, Welcome Creek, Wind River
	Centaurea diffusa	diffuse knapweed	Cabinet Mountains, Eagle Cap, Wenaha- Tucannon
	Centaurea maculosa	spotted knapweed	Absaroka Beartooth, Bob Marshall, Cabinet

			Mountains, Craters of the Moon, FC-RONR, Glacier, Great Bear, Gros Venture, Lee Metcalf, Lone Peak, Mission Mountains, Mt Nebo, Mt Timpanogos, Rattlesnake, Selway-Bitterroot, Teton, Welcome Creek, Wenaha-Tucannon, Wind River
	Centaurea solstitialis	yellow starthistle	FC-RONR, Selway Bitterroot
	Chondrilla juncea	rush skeleton-weed	FC-RONR
	Chrysanthemum leucanthemum	oxeye daisy	Absaroka Beartooth, Cabinet Mountains, Glacier, Great Bear, Lee Metcalf, Rattlesnake, Selway Bitterroot
	Cichorium intybus	chicory	Selway Bitterroot
	Cirsium arvense	canada thistle	Absaroka Beartooth, Bob Marshall, Cloud Peak, Craters of the Moon, Eagle Cap, Eagles Nest, Encampment River, Collegiate Peaks, Flat Tops, Fossil Ridge, FC-RONR, Glacier, Great Bear, Gros Venture, High Uintas, Holy Cross, Huston Park, Indian Peaks, La Garita, Lee Metcalf, Lone Peak, Mission Mountains, Mount Sneffels, Mt Nebo, Mt Timpanogos, Never Summer, Platte River, Raggets, Rattlesnake, Rocky Mountain NP, Scapegoat, Selway Bitterroot, Soldier Creek, Teton, Uncompahgre, Vasquez Peak, Washakie, Welcome Creek, West Elk, Wind River
	Cirsium vulgare	bull thistle	Scapegoat, Selway Bitterroot, Rocky Mountain NP
	Filago arvensia	field filago	Scapegoat
	Helianthus annuus	common sunflower	Lone Peak, Mt Nebo, Mt Timpanogos
	Hieracium aurantiacum	orange hawkweed	Cabinet Mountains, Salmo-Priest
	Hieracium caespitosum	yellow hawkweed	Salmo-Priest
	Hieracium spp	orange hawkweed	Glacier
	Onopordum acanthium	scotch thistle	FC-RONR, Gros Venture Selway Bitterroot, Teton, Wind River
	Senecio jacobaea	tansy ragwort	Bob Marshall
	Tanaceteum vulgare	common tansy	FC-RONR Rattlesnake, Selway Bitterroot
	Taraxacum officinale	dandelion	Absaroka Beartooth, High Uintas, Lee Metcalf, Scapegoat, Selway Bitterroot
	Tragopogon dubious	salsify	Craters of the Moon, Lone Peak, Mt Nebo, Mt Timpanogos, Welcome Creek
	Tribulus terrestris	puncture vine	Apache Creek
	Arctium minus	burdock	Wenaha- Tucannon, Selway Bitterroot
	Xanthium strumarium	cocklebur	Lone Peak, Mt Nebo, Mt Timpanogos
	Senecio jacobaea	tansy ragwort	Mission Mountains
Boraginaceae	*Cynoglossum officinale*	hound's tongue	Absaroka Beartooth, Flat Tops, Gros Venture, Holy Cross, Lee Metcalf, Mount Sneffels, Raggets, Rocky Mountain NP, Selway Bitterroot, Teton, Uncompahgre, Wenaha-Tucannon, West Elk, Wind River
Brassicaceae	*Arabis glabra*	towermustard	Scapegoat
	Brassica nigra	black mustard	Scapegoat
	Cardaria draba	whitetop	Lee Metcalf, Selway Bitterroot, Washakie
	Isatis tincoria	dyer's woad	FC-RONR, Lone Peak, Mt Naomi, Mt Nebo, Mt Timpanogos
Caryophyllaceae	*Media glomerata*	chickweed	Lone Peak, Mt Nebo, Mt Timpanogos
Chenopodiaceae	*Chenopodium album*	goosefoot	Lone Peak, Mt Nebo, Mt Timpanogos
	Chenopodium capitatum	strawberry blite goosefoot	Scapegoat
	Chenopodium nigra	lambsquarter	Scapegoat
	Chenopodium nigra	lambsquarter	Scapegoat
Euphorbiaceae	*Euphorbia esula*	leafy spurge	Absaroka-Beartooth, FC-RONR, Glacier,

			Gros Venture, Lee Metcalf, Platte River, Rocky Mountain NP, Scapegoat, Soldier Creek, Teton, Wind River
Fabaceae	*Medicago lupulina*	alfalfa	Rattlesnake, Scapegoat, Selway Bitterroot, Welcome Creek
	Melilotus officinale	yellow sweet clover	High Uintas, Lone Peak, Mt Nebo, Mt Timpanogos, Scapegoat
	Trifolium repens	white clover	Scapegoat
	Trifolium spp	clover	Absaroka Beartooth, Lee Metcalf, Rattlesnake, Scapegoat, Selway Bitterroot, Welcome Creek
Hypericaceae	*Hypericum perforatum*	St Johnswort	Glacier, Great Bear, Mission Mountains, Rattlesnake, Selway Bitterroot
Poaceae	*Aegilops cylindrica*	goatgrass	Lone Peak, Mt Nebo, Mt Timpanogos
	Agropyron spp	wheatgrass	Rocky Mountain NP
	Agrostis tenuis	colonial bentgrass	Scapegoat
	Avena fatua	wild oats	Wenaha- Tucannon
	Bromus inermis	smoothe brome	High Uintas, Lone Peak, Mt Nebo, Mt Timpanogos, Rattlesnake, Rocky Mountain NP, Selway Bitterroot, Soldier Creek, Welcome Creek
	Bromus japonica	japanese brome	Lone Peak, Mt Nebo, Mt Timpanogos
	Bromus tectorum	cheatgrass	Craters of the Moon, High Uintas, Lone Peak, Mt Nebo, Mt Timpanogos, Rattlesnake, Welcome Creek
	Dactylis glomerata	orchard grass	Cabinet Mountains, High Uintas, Rattlesnake, Scapegoat, Selway Bitterroot, Welcome Creek
	Lolium multiflorum	perennial ryegrass	Scapegoat
	Phleum pratense	timothy	Absaroka Beartooth, Bob Marshall, Cabinet Mountains, High Uintas, Lee Metcalf, Rattelsnake, Rocky Mountain NP, Scapegoat, Selway Bitterroot, Welcome Creek
	Poa pratense	kentucky bluegrass	Absaroka Beartooth, Cabinet Mountains, Rattlesnake, Scapegoat, Selway Bitterroot, Soldier Creek, Welcome Creek
	Ventenata dubia	ventenata	Wenaha- Tucannon
Polygonaceae	*Rumex acetellosa*	dock	High Uintas
Salicacaceae	*Populus alba*	white poplar	Lone Peak, Mt Nebo, Mt Timpanogos
Ranunculaceae	*Ranunculus testiculatus*	hornseed buttercup	Lone Peak, Mt Nebo, Mt Timpanogos
Rosaceae	*Potentilla recta*	sulfur cinquefoil	Absaroka Beartooth, FC-RONR, Glacier, Rattlesnake, Scapegoat, Selway Bitterroot, Welcome Creek, Wenaha- Tucannon
Scrophulariaceae	*Linaria dalmatica*	dalmation toadflax	Absaroka Beartooth, FC-RONR, Platte River, Wenaha- Tucannon
	Linaria genistifolia	toadflax	Lone Peak, Mt Nebo, Mt Timpanogos
	Linaria vulgaris	yellow toadflax	Absaroka Beartooth, Anaconda Pintler, Flat Tops, Holy Cross, Lee Metcalf, Raggets, Rocky Mountain NP, Selway Bitterroot, West Elk
	Verbascum thapsus	wooly mullein	Absaroka Beartooth, Bob Marshall, Craters of the Moon, FC-RONR, Lee Metcalf, Lone Peak, Mt Nebo, Mt Timpanogos, Rocky Mountain NP
Solanaceae	*Hyascyamus niger*	hen's bane	Absaroka Beartooth

Central prairie

Family	**Species**	**common name**	**Areas reporting**
Asteraceae	*Artemesia absinthium*	sage	Chase Lake
	Centaurea maculosa	spotted knapweed	Badlands

	Cirsium arvense	canada thistle	Badlands, UL Bend, Medicine Lake, Chase Lake
	Tragopogon pratensis	meadow salsify	Badlands
Brassicaceae	*Cardaria spp*	white top	UL Bend
Chenopodiaceae	*Halogeton glomeratus*	halogeton	Badlands
	Kochia scoparia	kochia	Badlands
	Salsola iberica		Badlands
Convulvulaceae	*Convulvulus arvensis*	bindweed	Badlands
Euphorbiaceae	*Euphorbia esula*	leafy spurge	Medicine Lake, Chase Lake
Fabaceae	*Melilotus alba*	white sweetclover	Badlands
	Melilotus officinale	yellow sweetclover	Badlands
Poaceae	*Agropyron cristatum*	crusted wheatgrass	Medicine Lake
	Agropyron repens	quackgrass	Medicine Lake
	Bromus inermis	smooth brome	Badlands, Medicine Lake, Chase Lake
	Bromus japonicus	japanese brome	Badlands
	Bromus tectorum	cheatgrass	Badlands
	Poa pratense	kentucky bluegrass	Badlands, Medicine Lake, Chase Lake
Scrophulariaceae	*Verbascum thapsis*	wooly mullein	Badlands
Tamaricaceae	*Tamarix ramosissima*	salt cedar	UL Bend

Great Lakes (Michigan and Wisconsin)

Family	**Species**	**common name**	**Areas reporting**
Apiaceae	*Daucus carota*	queen anne's lace	Delirium, Horseshoe Bay, Mackinac,Rock River Canyon, Round Island
Asteraceae	*Arctium minus*	common burdock	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Centaurea maculosa	spotted knapweed	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Chrysanthemum leucanthemum	ox eye daisy	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Cirsium arvense	canada thistle	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Cirsium palustre	marsh thistle	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Cirsium vulgare	bull thistle	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Hieracium aurantiacum	hawkweed	Blackjack Springs, Delirium, Headwaters, Horsehoe Bay, Mackinac, Whisker Lake, Rock River Canyon, Round Island
	Hieracium caespitosum	hawkweed	Porcupine Lake
	Hieracium perforatum	hawkweed	Whisker Lake, Blackjack Springs, Headwaters
	Hieracium piloselloides	hawkweed	Whisker Lake, Blackjack Springs, Headwaters
	Matricaria discoidea	pineapple weed	Rock River Canyon, Mackinac, Horsehoe Bay, Delirium, Round Island
	Matricaria matricoides	false chamomile	Whisker Lake, Blackjack Springs, Headwaters
	Sonchus arvensis		Whisker Lake, Blackjack Springs, Headwaters
	Tanacetum vulgare	tansy	Blackjack Springs, Delirium, Horseshoe Bay, Headwaters, Rock River Canyon, Mackinac, Round Island, Whisker Lake
	Taraxacum officinale	dandelion	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac,

			Horseshoe Bay, Delirium, Round Island
	Tragopogon pratensis	salsify	Whisker Lake, Blackjack Springs, Headwaters
	Centaurea maculosa	spotted knapweed	Nordhouse Dunes
Berberidaceae	*Berberis thunbergii*	japanese barberry	Whisker Lake, Blackjack Springs, Headwaters
Berberidaceae	*Berberis vulgaris*	common barberry	Round Island
Brassicaceae	*Barbarea vulgaris*	mustard	Whisker Lake, Blackjack Springs, Headwaters
Caprifoliaceae	*Lonicera japonica*	japanese honeysuckle	Round Island
	Lonicera morrowii	fly honeysuckle	Round Island
	Lonicera tatarica	Tartarian honeysuckle	Round Island
	Lonicera x bella	bell's honeysuckle	Round Island
Caryophyllaceae	*Cerastium vulgatum*	chickweed	Whisker Lake, Blackjack Springs, Headwaters
	Dianthus armeria		Whisker Lake, Blackjack Springs, Headwaters
	Lychnis alba	catchfly	Whisker Lake, Blackjack Springs, Headwaters
	Saponaria officinalis	saponaria	Rock River Canyon, Horseshoe Bay, Mackinac, Delirium, Round Island
	Silene vulgaris	catchfly	Whisker Lake, Blackjack Springs, Headwaters
Chenopodiaceae	*Chenopodium album*	goosefoot	Whisker Lake, Blackjack Springs, Headwaters
Fabaceae	*Coronilla varia*	crown vetch	Horseshoe Bay
	Lathyrus tuberosus	sweet pea	Rainbow Lake
	Lotus corniculata	bird's foot trefoil	Rock River Canyon, Mackinac, Horsehoe Bay, Delirum, Round Island, Whisker Lake, Blackjack Springs, Headwaters
	Medicago lupulina	alfalfa	Whisker Lake, Blackjack Springs, Headwaters
	Medicago sativum	alfalfa	Rock River Canyon, Mackinac, Horsehoe Bay, Delirium, Round Island
	Melilotus alba	white clover	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horsheshoe Bay, Delirium, Round Island
Fabaceae	*Melilotus officinale*	yellow sweet clover	Mackinac, Horseshoe Bay, Delirium, Round Island
	Trifolium aureum	clover	Whisker Lake, Blackjack Springs, Headwaters
	Trifolium hybridum	clover	Whisker Lake, Blackjack Springs, Headwaters
	Trifolium pratense	clover	Whisker Lake, Blackjack Springs, Headwaters
	Trifolium repens	clover	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Trifolium spp	clover	Rock River Canyon, Horseshoe Bay, Mackinac, Delirium, Round Island
Hypericaceae	*Hypericum perforatum*	St Johnswort	Nordhouse Dunes, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
Lamiaceae	*Prunella vulgaris*	self heal	Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
Orchidaceae	*Epipactus helleborine*		Sturgeon River Gorge
Passifloraceae	*Pastinaca sativa*		Whisker Lake, Blackjack Springs, Headwaters
Plantaginaceae	*Plantago lanceolata*	plantain	Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
Plantaginaceae	*Plantago major*	plantain	Rock River Canyon, Mackinac, Horseshoe

			Bay, Delirium, Round Island
Poaceae	*Anthoxanthum aristatum*		Sipsey
	Bromus inermis	smooth brome	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Dactylis glomerata	orchard grass	Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Festuca elatior	fescue	Whisker Lake, Blackjack Springs, Headwaters
	Phleum pratense	timothy	Whisker Lake, Blackjack Springs, Headwaters
	Poa annua	annual bluegrass	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Poa compressa	canada bluegrass	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Poa pratensis	kentucky bluegrass	Whisker Lake, Blackjack Springs, Headwaters
			Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Rumex acetosella	sheep sorrel	Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Rumex obtusifolius	dock	Whisker Lake, Blackjack Springs, Headwaters
Portulacaceae	*Portulaca oleracea*		Whisker Lake, Blackjack Springs, Headwaters
Ranunculaceae	*Ranunculus acris*	tall buttercup	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
Rosaceae	*Potentilla recta*		Whisker Lake, Blackjack Springs, Headwaters
Salicaceae	*Populus nigra*	lombardy pine	Nordhouse Dunes
Scrophulariaceae	*Linaria vulgaris*	toadflax, butter and eggs	Whisker Lake, Blackjack Springs, Headwaters, Rock River Canyon, Mackinac, Horseshoe Bay, Delirium, Round Island
	Verbasum thapsus	mullein	Whisker Lake, Blackjack Springs, Headwaters
	Veronica beccabunga	speedwell	Whisker Lake, Blackjack Springs, Headwaters
	Veronica officinalis	speedwell	Whisker Lake, Blackjack Springs, Headwaters
Solanaceae	*Solanum dulcamara*		Sturgeon River Gorge
Molluginaceae	*Galeopsos tetrahit*		Sturgeon River Gorge
	Mollugo verticulata		Whisker Lake, Blackjack Springs, Headwaters

Eastern temperare (SW)

Family	**species**	**common name**	**Areas reporting**
Caprifoliaceae	*Lonicera japonica*	japanese honeysuckle	Black Fork Mountain, Caney Creek, Clifty, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi, Sipsey
	Lonicera maackii		Clifty
Elaeagnaceae	*Elaeagnus spp*	russian olive	Sipsey
	Elaegnus umbellata		Beaver Creek, Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi
Fabaceae	*Albizia julibrissin*	silktree, mimosa	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi, Sipsey

	Lespedeza cuneata		Beaver Creek, Black Fork Mountain, Caney Creek, Clifty, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi
	Lespedeza spp	bicolor, sericea lespedeza	Sipsey
	Pueraria lobata	kudzu	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi, Sipsey
	Pueraria montana		Beaver Creek
Lamiaceae	*Mosla dianthera*		Beaver Creek
Oleaceae	*Ligustrum spp.*	privet	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi, Sipsey
Poaceae	*Anthoxanthum aristatum*		Sipsey
	Festuca ky31	fescue	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi
	Lolium perenne	perennial ryegrass	Sipsey
	Microstegium vimineum	Japanese grass	Beaver Creek, Clifty, Sipsey
	Paspalum dilatiatum		Sipsey
	Poa annua	annual bluegrass	Sipsey
Rosaceae	*Prunus mexicana*		Sipsey
	Prunus persica		Sipsey
	Rosa multiflora	rose	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi
Simaroubiaceae	*Ailanthus altissima*	tree of heaven	Black Fork Mountain, Caney Creek, Dry Creek, Flatside, Poteau Mountain, Upper Kiamichi

Eastern temperate forest: Appalachian and Northeastern states

Family	**Species**	**common name**	**Areas reporting**
Asclepiadaceae	*Cynanchum nigrum & spp*	black swallowwort	Adirondack State Park
Bignoniaceae	*Paulownia tomentosa*		Shenandoah
Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	Shenandoah
	Lonicera morrowii	fly honeysuckle	Adirondack State Park
	Lonicera tatarica	tatarian honeysuckle	Adirondack State Park
Celastraceae	*Celastrus orbiculatus*	Asiatic bittersweet	Shenandoah
Fabaceae	*Coronilla varia*	crown vetch	Adirondack State Park
	Melilotus alba	white sweet clover	Adirondack State Park
	Pueraria lobata	kudzu	Shenandoah
	Robinia pseudoacacia	black locust	Adirondack State Park
Haloragaceae	*Myriophyllum spicatum*	Eurasian water-milfoil	Adirondack State Park
Hydrocharitaceae	*Hydrocharis morsus-ranae*	frogbit	Adirondack State Park
Lamiaceae	*Perilla frutescens*	perilla	Shenandoah
Liliaceae	*Alliaria petiolata*	garlic mustard	Adirondack State Park, Shenandoah
Lythraceae	*Lythrum salicaria*	Purple loosestrife	Adirondack State Park
Poaceae	*Microstegium vimineum*	Japanese grass	Shenandoah
	Phalaris arundinacea	reed canary grass	Adirondack State Park
	Phragmites australis	common reed grass	Adirondack State Park
	Poa compressa	Canada bluegrass	Adirondack State Park
Polygonaceae	*Polygonum cuspidatum*	Japanese knotweed	Adirondack State Park, Shenandoah
Rhamnaceae	*Rhamnus cathartica*	common buckthorn	Adirondack State Park
Rosaceae	*Rubus phoenicolasices*		Shenandoah
Simaroubiaceae	*Ailanthus altissima*	tree of heaven	Shenandoah
Trapaceae	*Trapa natans*	water chesnut	Adirondack State Park, Shenandoah

Southeastern coast, bogs, marsh and swamps

Family	**Species**	**common name**	**Areas reporting**
Amaranthaceae	*Alternanthera philoxeroides*	alligatorweed	Lacassine
Anacardiaceae	*Schinus terebinthifolius*	brazilian pepper	J.N. "Ding" Darling, Florida Keys
Caprifoliaceae	*Lonicera japonicum*	japanese honeysuckle	Little Wambaw Swamp, Hellhole Bay, Wambaw Creek, Wambaw Swamp
Casuarinaceae	*Casuarina equisetifolia*	Australian pine	Florida Keys, J.N. "Ding" Darling
Euphorbiaceae	*Sapium sebiferum*	chinese tallow tree	Gulf Islands NSS, Lacassine, Little Wambaw Swamp, Hellhole Bay, Wambaw Creek, Wambaw Swamp, St. Marks
Fabaceae	*Leucaena leucocephala*	leadtree	Florida Keys
Goodeniaceae	*Scaevola taccada var sericea*		Florida Keys
Hydrocaritaceae	*Hydrilla verticillata*	hydrilla	Lacassine
	Ottella alismoides		Lacassine
Lauraceae	*Cinnamomum camphora*		Bradwell Bay, Juniper Prairie, Mud Swamp
Malvaceae	*Hibiscus tiliaceus*	hibiscus	Florida Keys
	Thespesia populea		Florida Keys
Meliaceae	*Melia azedarach*		Bradwell Bay, Juniper Prairie, Mud Swamp
Oleaceae	*Ligustrum japonicum*		Hellhole Bay
	Ligustrum sinense	privet	Bradwell Bay, Juniper Prairie, Mud Swamp, Little Wambaw Swamp, Hellhole Bay, Wambaw Creek, Wambaw Swamp
Poaceae	*Dactyloctenium aegyptium*		Florida Keys
	Imperata cylindrica	cogon grass	Juniper Prairie, St. Marks
	Microstegium vimineum		Little Wambaw Swamp, Hellhole Bay, Wambaw Creek, Wambaw Swamp
Pondeteraceae	*Eichhornla crassipes*	water hyacinth	Lacassine
Rhamnaceae	*Colubrina asiatica*	latherleaf	Florida Keys
Schizaeaceae	*Lygodium japonicum*		Bradwell Bay, Juniper Prairie, Mud Swamp
Solanaceae	*Dioscorea bulbifera*	air potato	Juniper Prairie
Hydrocharitaceae	*Blyxa aubertii*	round fruit blyxa	Lacassine

APPENDIX III.

Backcountry weed report forms for the Absaroka-Beartooth Wilderness and Glacier National Park.

Absaroka-Beartooth Wilderness
Gallatin National Forest

WEED INVENTORY FORM

Inventoried by: ______________________ Inventory date: __________

Region: ____ Forest: ____ District: ____ State: ____ County: ____

Quad Map Name: __________________________
UTM: ______________ Latitude: ____ ____ Longitude: ____ ____
Elevation: ____ Aspect: ____
Drainage name: __________________________
Trail number: ______ Road number: ______ Trailhead name: ____________________

Are target weed species present?: _____Y _____N (list below if present)
Is this a new infestation?: _____Y _____N

Weed species	Canopy Cover ** L - M - H	Area (acres)	Number of Plant
Spotted knapweed			
Leafy Spurge			
Dalmation toadflax			
Houndstongue			
Canada thistle			

Land use:
____trailhead ____road ____campsite ____lake ____stream
____grazed meadow (past or current)
____ungrazed meadow (no recent history of grazing by domestic stock)
____other____________

Treatment:
____grubbing ____chemical ____biological ____mowing/cutting

Chemical name: ______________________________
Application rate: ______________________________
Application method: ______________________________
Date of treatment: ______________

General Site Description and Location Information: ______________________

** Canopy Cover
L - Low < 10% canopy cover
M - Moderate 10% to 25% canopy cover
H - High 25% to 100% canopy cover

SURVEY FORM: EXOTIC PLANTS IN NATURAL AND DEVELOPED AREAS

ecorder: ____________________ Date: ____/____/____ # of people surveying _____ employee _____ volunteer Time spent surveying ______ hours/minutes

rainage __________________ Site #: ___________ Name of Area: ______________________________________ UTM _ _ _ . _ E _ _ _ _ . _ N

lant community (enter for each unit): for = forest shr = shrub gra = grassland bar = barren mix = mixed alp = alpine

ater present (circle those that apply): lake stream wetland pond riparian

anopy cover categories:

= no exotic plants found
= trace, a few plants, < 1% canopy cover
= low, scattered plants, 1% to 10% canopy cover
= moderate, patches of plants, 10% to 25% canopy cover
= high, predominant plant, > 25% canopy cover

Exotic species codes:

CENMAC = spotted knapweed
EUPESU = leafy spurge
HIEAUR = orange hawkweed
List other exotics by common or scientific name
CHRLEU = oxeye daisy
HYPPER = St. Johnswort
POTREC = sulfur cinquefoil

MAP LOCATION AND LIST # OF ALL INFESTATION UNITS ON ATTACHED MAP OR DRAW MAP AT RIGHT IF THERE IS NO AVAILABLE MAP.
MEASURE OR ESTIMATE LENGTH AND WIDTH (1) OF UNIT IF YOU CAN; IF UNIT IS TOO LARGE, THEN ESTIMATE ACREAGE OF UNIT (2).
1 MILE = 5,280 ft or 1,760 yd 1 ACRE = 43,560 ft² (209 ft x 209 ft) or 4,840 yd² (69 yd x 69 yd)
COMMENTS CAN INCLUDE LANDMARKS TO LOCATE UNIT, OPINION OF INCREASE/DECREASE IN POPULATION, IF PLANTS ARE FLOWERING, OBSERVATIONS ON ANIMAL BROWSE ON WEEDS, ETC.

Unit	Plant Community	Species	Canopy cover	(1) Length of unit (ft)	(1) Width of unit (ft)	(2) Acreage of unit	Comments

Glacier National Park

TREATMENT FORM: EXOTIC PLANTS IN NATURAL AND DEVELOPED AREAS

Recorder: ____________________ Date: ____/____/____ Site #: _______ Name of Area: ____

Drainage ________________ # of people working ____ employee ____ volunteer

Water present (circle those that apply): lake stream wetland pond riparian

Exotic species codes:

CENMAC = spotted knapweed **CHRLEU** = oxeye daisy **EUPESU** = leafy spurge **HYPPER** = St. Johnswort

HIEAUR = orange hawkweed **POTREC** = sulfur cinquefoil List other exotics by common or scientific name

- **MAP LOCATION AND LIST # OF TREATMENT UNITS ON ATTACHED MAP OR DRAW MAP AT RIGHT IF THERE IS NO AVAILABLE MAP.**
- **MEASURE OR ESTIMATE LENGTH AND WIDTH (1) OF UNIT IF YOU CAN; IF UNIT IS TOO LARGE, THEN ESTIMATE ACREAGE OF UNIT (2).**
- **1 MILE = 5,280 ft or 1,760 yd 1 ACRE = 43,560 ft² (209 ft x 209 ft) or 4,840 yd² (69 yd x 69 yd)**
- **COMMENTS CAN INCLUDE IF ROOTS ARE BEING PULLED, IF PLANTS ARE FLOWERING, ETC.**

Unit	Species	(1) Length of unit treated (ft)	(1) Width of unit treated (ft)	(2) Acreage of unit treated	Treatment (pull, spray, weedwhip, mow)	Time spent treating unit (hours/minutes)	OPTIONAL: # of plants treated	Comments

Glacier National Park

Appendix IV. List of participating Wilderness areas.

State	Agency	Wilderness name	Unit	Status
AK	FS	Admiralty Island	Tongass NF	Designated
AK	FS	Coronation Island	Tongass NF	Designated
AK	FS	Endicott River	Tongass NF	Designated
AK	FS	Karta River	Tongass NF	Designated
AK	FS	Kootzoowoo	Tongass NF	Designated
AK	FS	Kuiu	Tongass NF	Designated
AK	FS	Maurelle Islands	Tongass NF	Designated
AK	FS	Misty Fiords	Tongass NF	Designated
AK	FS	Petersburg CR-Duncan Salt CK	Tongass NF	Designated
AK	FS	Pleasant/Lemusurier/Inian Islands	Tongass NF	Designated
AK	FS	Russel Fiord	Tongass NF	Designated
AK	FS	South Baranof	Tongass NF	Designated
AK	FS	South Etolin	Tongass NF	Designated
AK	FS	South Prince of Wales	Tongass NF	Designated
AK	FS	Stikine-Leconte	Tongass NF	Designated
AK	FS	Tebenkof Bay	Tongass NF	Designated
AK	FS	Tracy Arm-Fords Terror	Tongass NF	Designated
AK	FS	Warren Island	Tongass NF	Designated
AK	FS	West of Chicogof-Yakobi	Tongass NF	Designated
AK	FWS	Aleutian Islands	Aleutian Islands Unit, Alaska Maritime NWR	Designated
AK	FWS	Andreafsky	Yukon Delta NWR	Designated
AK	FWS	Becharof	Becharof NWR	Designated
AK	FWS	Izembek	Izembek NWR	Designated
AK	FWS	Kenai	Kenai NWR	Designated
AK	FWS	Nunivak Island	Yukon Delta NWR	Designated
AK	FWS	Saint Lazaria	Alaska Maritime NWR	Designated
AK	FWS	Selawik	Selawik NWR	Designated
AK	FWS	Togiak	Togiak NWR	Designated
AK	NPS	Denali	Denali NP	Designated
AK	NPS	Gates of the Arctic	Gates of the Arctic	Designated
AL	FS	Sipsey	Bankhead NF	Designated
AR	FS	Black Fork Mountain	Ouachita NF	Designated
AR	FS	Caney Creek	Ouachita NF	Designated
AR	FS	Dry Creek	Oachita NF	Designated
AR	FS	Flatside	Ouachita NF	Designated
AR	FS	Poteau Mountain	Ouachita NF	Designated
AR	FS	Upper Kiamichi	Ouachita NF	Designated
AZ	BLM	Aravaipa Canyon	Phoenix Field Office	Designated
AZ	BLM	Aravaipa Canyon	Stafford District	Designated
AZ	BLM	Baboquivari	Tuscon Field Office	Designated
AZ	BLM	Beaver Dam Mountains	Arizona Strip District	Designated
AZ	BLM	Bighorn Mountains	Phoenix Field Office	Designated
AZ	BLM	Cactus Plain WSA	Lake Havasu Field Office	WSA
AZ	BLM	Cottonwood Point	Arizona Strip District	Designated
AZ	BLM	Coyote Mountains	Tuscon Field Office	Designated
AZ	BLM	Dos Cabezas	Phoenix Field Office	Designated
AZ	BLM	Eagletail Mountains	Yuma Field Office	Designated
AZ	BLM	East Cactus Plain	Lake Havasu Field Office	Designated
AZ	BLM	Fishhooks	Phoenix Field Office	Designated
AZ	BLM	Gibraltar Mountain	Lake Havasu Field Office	Designated
AZ	BLM	Grand Wash Cliffs	Arizona Strip District	Designated
AZ	BLM	Harcuvar Mountains	Lake Havasu Field Office	Designated
AZ	BLM	Harquahala	Phoenix Field Office	Designated

AZ	BLM	Hausayampa River Canyon	Phoenix Field Office	Designated
AZ	BLM	Hells Canyon Wilderness	Phoenix Field Office	Designated
AZ	BLM	Hummingbird Springs	Phoenix Field Office	Designated
AZ	BLM	Mount Logan	Arizona Strip District	Designated
AZ	BLM	Mt Trumball	Arizona Strip District	Designated
AZ	BLM	Muggins Mountain	Yuma Field Office	Designated
AZ	BLM	New Water Mountains	Yuma Field Office	Designated
AZ	BLM	North Maricopa	Phoenix Field Office	Designated
AZ	BLM	North Santa Teresa	Phoenix Field Office	Designated
AZ	BLM	Paiute	Arizona Strip District	Designated
AZ	BLM	Paria River	Arizona Strip District	Designated
AZ	BLM	Peloncillo Mountains	Phoenix Field Office	Designated
AZ	BLM	Rawhide Mountains	Lake Havasu Field Office	Designated
AZ	BLM	Redfield Canyon	Phoenix Field Office	Designated
AZ	BLM	Sierra Estrella	Phoenix Field Office	Designated
AZ	BLM	Signal Mountain	Phoenix Field Office	Designated
AZ	BLM	South Maricopa	Phoenix Field Office	Designated
AZ	BLM	Swansea	Lake Havasu Field Office	Designated
AZ	BLM	Table Top	general	Designated
AZ	BLM	Table Top	Phoenix Field Office	Designated
AZ	BLM	Trigo Mountain	Yuma Field Office	Designated
AZ	BLM	Vermillion Cliffs	Arizona Strip District	Designated
AZ	BLM	White Canyon	general	Designated
AZ	BLM	White Canyon	Tuscon Field Office	Designated
AZ	BLM	Woolsey Peak	Phoenix Field Office	Designated
AZ	FS	Apache Creek	Prescott NF	Designated
AZ	FS	Chiricahua	Coronado NF	Designated
AZ	FS	Fossil Springs	Coconino NF	Designated
AZ	FS	Four Peaks	Tonto NF	Designated
AZ	FS	Galiuro	Coronado NF	Designated
AZ	FS	Hell's Gate	Tonto NF	Designated
AZ	FS	Juniper Mesa	Prescott NF	Designated
AZ	FS	Kachina Peaks	Coconino NF	Designated
AZ	FS	Kanab	Kaibab NF	Designated
AZ	FS	Kendrick Mountain	Coconino NF	Designated
AZ	FS	Kendrick Mountain	Kaibab NF	Designated
AZ	FS	Mazatzal	Coconino NF	Designated
AZ	FS	Mazatzal	Tonto NF	Designated
AZ	FS	Miller Peak	Coronado NF	Designated
AZ	FS	Mt. Wrightson	Coronado NF	Designated
AZ	FS	Munds Mountain	Coconino NF	Designated
AZ	FS	Pajarita	Coronado NF	Designated
AZ	FS	Pine Mountain	Prescott NF	Designated
AZ	FS	Pine Mountain	Tonto NF	Designated
AZ	FS	Pusch Ridge	Coronado NF	Designated
AZ	FS	Pusch Ridge	general	Designated
AZ	FS	Red Rock-Secret Mountain	Coconino NF	Designated
AZ	FS	Rincon Mountain	Coronado NF	Designated
AZ	FS	Saddle Mountain	Kaibab NF	Designated
AZ	FS	Salome	Tonto NF	Designated
AZ	FS	Santa Teresa	Coronado NF	Designated
AZ	FS	Sierra Ancha	Tonto NF	Designated
AZ	FS	Strawberry Crater	Coconino NF	Designated
AZ	FS	Superstition	Tonto NF	Designated
AZ	FS	Sycamore Canyon	Coconino NF	Designated
AZ	FS	Sycamore Canyon	Prescott NF	Designated
AZ	FS	West Clear Creek	Coconino NF	Designated
AZ	FS	Wet Beaver	Coconino NF	Designated

AZ	FS	Woodchute	Prescott NF	Designated
AZ	FWS	Cabeza Prieta	general	Designated
AZ	FWS	Kofa	interagency	Designated
AZ	FWS	Needles Peaks	Havasu NWR	Designated
AZ	NPS	Organ Pipe Cactus	Organ Pipe Cactus National Monument	Designated
AZ	NPS	Saguaro	general	Designated
AZ	NPS	Saguaro	Saguaro NP	Designated
CA	FS	Agua Tibia	Cleveland NF	Designated
CA	FS	Ansel Adams	Sierra NF	Designated
CA	FS	Caribou	Lassen NF	Designated
CA	FS	Chumash	Mt Pinos RD, Los Padres NF	Designated
CA	FS	Dick Smith	Mt Pinos RD, Los Padres NF	Designated
CA	FS	Dick Smith	Santa Barbara RD, Los Padres NF	Designated
CA	FS	Dinkey Lakes	Sierra NF	Designated
CA	FS	Domeland	Sequoia NF	
CA	FS	Garcia	Santa Lucia RD, Los Padres NF	Designated
CA	FS	Golden Trout	Inyo NF	Designated
CA	FS	Granite Chief	Tahoe NF	Designated
CA	FS	Hauser	Cleveland NF	Designated
CA	FS	Ishi	Lassen NF	Designated
CA	FS	John Muir	Inyo NF	Designated
CA	FS	John Muir	Sierra NF	Designated
CA	FS	Kaiser	Sierra NF	Designated
CA	FS	Machesna	Santa Lucia RD, Los Padres NF	Designated
CA	FS	Matilija	Ojai RD, Los Padres NF	Designated
CA	FS	Monarch	Sierra NF	Designated
CA	FS	North Fork	Six Rivers	Designated
CA	FS	Pine Creek	Cleveland NF	Designated
CA	FS	San Mateo	Cleveland NF	Designated
CA	FS	San Rafael	Santa Barbara RD, Los Padres NF	Designated
CA	FS	San Rafael	Santa Lucia RD, Los Padres NF	Designated
CA	FS	Santa Lucia	Santa Lucia RD, Los Padres NF	Designated
CA	FS	Sespe	Mt Pinos RD, Los Padres NF	Designated
CA	FS	Sespe	Ojai RD, Los Padres NF	Designated
CA	FS	Silver Peak	Monterey RD, Los Padres NF	Designated
CA	FS	Snow Mountain	Mendocino NF	Designated
CA	FS	South Sierra	Inyo NF	Designated
CA	FS	Thousand Lakes	Lassen NF	Designated
CA	FS	Trinity Alps	Six Rivers NF	Designated
CA	FS	Ventana	Monterey RD, Los Padres NF	Designated
CA	FS	Yolla Bolly	Mendocino NF	Designated
CA	FS	Yolla Bolly	Six Rivers NF	Designated
CA	FS	Yosemite	Yosemite NP	Designated
CA	FWS	Chemhuevi Mountains	Havasu NWR	Designated
CA	FWS	Farallon	San Francisco Bay NWR	Designated
CA	NPS	Mojave National Preserve	Mojave National Preserve	Designated
CA	NPS	Phillip Burton	Point Reyes	Designated
CA	NPS	Sequoia- Kings Canyon	Sequoia-Kings NP	Designated
CA	FS	Golden Trout	Sequoia NF	Designated
CA	FS	Jennie Lake	Sequoia NF	Designated
CA	FS	Kiavah	Sequoia NF	Designated
CA	FS	Monarch	Sequoia NF	Designated
CA	FS	South Sierra	Sequoia NF	Designated
CO	FS	Byers Peak/ St Louis	Sulphur RD	Designated
CO	FS	Collegiate Peaks	Gunn-Unc-GM	Designated
CO	FS	Collegiate Peaks	Leadeville RD	Designated
CO	FS	Eagles Nest	White River NF	Designated
CO	FS	Flat Tops	White River NF	Designated

CO	FS	Fossil Ridge	Gunn-Unc-GM	Designated
CO	FS	Holy Cross	White River NF	Designated
CO	FS	Indian Peaks	Sulphur RD	Designated
CO	FS	La Garita	GM-UNC_GUNN NF	Designated
CO	FS	Maroon Bells- Snowmass	GM-UNC_GUNN NF	Designated
CO	FS	Maroon Bells- Snowmass	White River NF	Designated
CO	FS	Mount Sneffels	GM-UNC_GUNN NF	Designated
CO	FS	Mt Massive	Leadeville RD	Designated
CO	FS	Never Summer	Shoshone NF	Designated
CO	FS	Raggets	GM-UNC_GUNN NF	Designated
CO	FS	Soldier Creek	Nebraska NF	Designated
CO	FS	Uncompahgre	GM-UNC-GUNN NF	Designated
CO	FS	Vasquez Peak	Sulphur RD	Designated
CO	FS	West Elk	GM-UNC-GUNN NF	Designated
CO	NPS	Rocky Mountain NP	Rocky Mountain NP	Designated
FL	FS	Bradwell Bay	Apalachicola NF	Designated
FL	FS	Juniper Prairie	Ocala NF	Designated
FL	FS	Mud Swamp	Ocala NF	Designated
FL	FWS	Chassahowizka	Chassahowitzka NWR Complex	Designated
FL	FWS	Florida Keys	Key West NWR/ Great White Heron NWR/ Deer Key NWR	Designated
FL	FWS	J.N. "Ding" Darling	J.N. "Ding" Darling NWR	Designated
FL	FWS	St. Marks	St. Marks NWR	Designated
GA	FS	Big Frog	Chattahoochee NF	Designated
GA	FS	Blood Mountain	Chattahoochee NF	Designated
GA	FS	Brasstown	Chattahoochee NF	Designated
GA	FS	Cohutta	Chattahoochee NF	Designated
GA	FS	Ellicott Rock	Chattahoochee NF	Designated
GA	FS	Mark Trail	Chattahoochee NF	Designated
GA	FS	Raven Cliffs	Chattahoochee NF	Designated
GA	FS	Rich Mountain	Chattahoochee NF	Designated
GA	FS	Southern Nantahala	Chattahoochee NF	Designated
GA	FS	Tray Mountain	Chattahoochee NF	Designated
ID	FS	Cabinet Mountains	Idaho Panhandle NF	Designated
ID	FS	Frank Church- River of No Return	Salmon River RD	Designated
ID	FS	Frank Church-River of No Return	Challis NF	Designated
ID	FS	Frank Church-River of No Return	Salmon NF	Designated
ID	FS	Gospel Hump	Salmon River RD	Designated
ID	FS	Salmo-Priest	Idaho Panhandle NF	Designated
ID	FS	Selway Bitterroot	Moose Creek and Selway RD (Nez Perce NF)	Designated
ID	NPS	Craters of the Moon	Craters of the Moon NM	Designated
KY	FS	Beaver Creek	Daniel Boone NF	Designated
KY	FS	Clifty	Daniel Boone NF	Designated
LA	FWS	Breton Island	Breton NWR	Designated
LA	FWS	Lacassine	Lacassine NWR	Designated
MI	FS	Big Island	Hiawatha NF	Designated
MI	FS	Delirium	Hiawatha NF	Designated
MI	FS	Horseshoe Bay	Hiawatha NF	Designated
MI	FS	Mackinac	Hiawatha NF	Designated
MI	FS	McCormick	Ottowa NF	Designated
MI	FS	Nordhouse Dunes	Huron-Manistee NF	Designated
MI	FS	Rock River Canyon	Hiawatha NF	Designated
MI	FS	Round Island	Hiawatha NF	Designated
MI	FS	Sturgeon River Gorge	Ottowa NF	Designated
MI	FS	Sylvania	Ottowa NF	Designated
MS	NPS	Gulf Islands NSS	Mississippi District	Designated
MT	BLM	Lee Metcalf	BLM	Designated
MT	FS	Absaroka Beartooth	Gallatin NF	Designated
MT	FS	Absaroka-Beartooth	Custer NF	Designated

MT	FS	Anaconda Pintler	Beaverhead-Deerlodge NF	Designated
MT	FS	Bob Marshall	Lewis and Clark NF	Designated
MT	FS	Bob Marshall	Spotted Bear RD	Designated
MT	FS	Cabinet Mountains	Idaho Panhandle NF	Designated
MT	FS	Cabinet Mountains	Kootenai NF- Libby RD	Designated
MT	FS	Great Bear	Flathead NF	Designated
MT	FS	Lee Metcalf	Beaverhead-Deerlodge NF	Designated
MT	FS	Lee Metcalf	Gallatin NF	Designated
MT	FS	Mission Mountains	Flathead NF	Designated
MT	FS	Rattlesnake	Lolo NF	Designated
MT	FS	Scapegoat	Lewis and Clark NF	Designated
MT	FS	Scapegoat	Missoula RD	Designated
MT	FS	Selway- Bitterroot	Bitterroot NF	Designated
MT	FS	Selway-Bitterroot	Lolo NF	Designated
MT	FS	Selway-Bitterroot	Powell RD	Designated
MT	FS	Welcome Creek	Lolo NF	Designated
MT	FWS	Medicine Lake	Medicine Lake NWR	Designated
MT	FWS	UL Bend	Charles M. Russel NWR	Designated
MT	NPS	Glacier	Glacier NP	Proposed
ND	FWS	Chase Lake	Chase Lake NWR	Designated
NE	FS	Black Elk	Custer Elk Mountain RD	Designated
NM	BLM	Cebolla	Abuquerque District	Designated
NM	BLM	West Malpais	Abuquerque District	Designated
NM	FS	Aldo Leopold	Gila NF	Designated
NM	FS	Apache Kid	Cibola NF	Designated
NM	FS	Capitan Mountain	Lincoln NF	Designated
NM	FS	Gila	Gila NF	Designated
NM	FS	Sandia Mountains	Sandia RD	Designated
NM	FS	White Mountain	Lincoln NF	Designated
NM	FS	Withington	Cibola NF	Designated
NM	FWS	Chupadera	Bosque del Apache NWR	Designated
NM	FWS	Indian Wells	Bosque del Apache NWR	Designated
NM	FWS	Little San Pascual	Bosque del Apache NWR	Designated
NM	NPS	Bandelier	Bandelier National Monument	Designated
NV	BLM	Mt. Moriah	BLM	Designated
NV	FS	Current Mountain	Humbolt-Toiyabe NF	Designated
NV	FS	East Humbolt	Humbolt-Toiyabe NF	Designated
NV	FS	Grant Range	Humbolt-Toiyabe NF	Designated
NV	FS	Jarbridge	Humbolt-Toiyabe NF	Designated
NV	FS	Mount Moriah	Humbolt-Toiyabe NF	Designated
NV	FS	Quinn Canyon	Humbolt-Toiyabe NF	Designated
NV	FS	Ruby Mountains	Humbolt-Toiyabe NF	Designated
NV	FS	Santa Rosa- Paradise Peak	Humbolt-Toiyabe NF	Designated
NV	NPS	Lake Mead	Lake Mead NRA	National Recr
NY	NY State	Adirondack State Park	Adirondack Land Trust	State Park
OR	BLM	Jordan RA wsa	Vale District	WSA
OR	BLM	Juniper Dunes	Spokane District Office	Designated
OR	BLM	Little Sink ACEC	Salem District	WSA
OR	BLM	Malheur RA wsa	Vale District	WSA
OR	BLM	Table Rock	Salem District	Designated
OR	FS	Black Canyon	Ochoco NF	Designated
OR	FS	Bridge Creek	Ochoco NF	Designated
OR	FS	Diamond Peak	Deschutes NF	Designated
OR	FS	Eagle Cap	Wallowa Valley Ditrict	Designated
OR	FS	Gearhart	Fremont NF- Silver Lake RD	Designated
OR	FS	Hell's Canyon	Wallowa Valley Ditrict	Designated
OR	FS	Middle Santiam	Willamette NF	Designated
OR	FS	Mount Jefferson	Deschutes NF	Designated

OR	FS	Mount Thielsen	Deschutes NF	Designated
OR	FS	Mount Washington	Deschutes NF	Designated
OR	FS	Three Sisters	Deschutes NF	Designated
OR	FS	Wenaha- Tucannon	Umatilla NF	Designated
OR	FWS	Oregon Islands	Oregon Coastal Refuges	Designated
PA	FS	Hickory Creek	Allegheny NF	Designated
SC	FS	Ellicott Rock	Francis Marion- Sumter NF	Designated
SC	FS	Hellhole Bay	Francis Marion- Sumter NF	Designated
SC	FS	Little Wambaw Swamp	Francis Marion- Sumter NF	Designated
SC	FS	Wambaw Creek	Francis Marion- Sumter NF	Designated
SC	FS	Wambaw Swamp	Francis Marion- Sumter NF	Designated
SD	NPS	Badlands	Badlands NP	Designated
UT	FS	Dark Canyon	Manti- Lasal NF	Designated
UT	FS	High Uintas	Ashley NF	Designated
UT	FS	Lone Peak	Uinta NF	Designated
UT	FS	Mount Naomi		Designated
UT	FS	Mt Nebo	Uinta NF	Designated
UT	FS	Mt Timpanogos	Uinta NF	Designated
VA	NPS	Shenandoah	Shenandoah National Park	Designated
WA	FS	Alpine Lakes	Leavenworth RD	Designated
WA	FS	Alpine Lakes	Mt Baker/Snoqualmie NF	Designated
WA	FS	Boulder River	Mt Baker/Snoqualmie NF	Designated
WA	FS	Clearwater	Mt Baker/Snoqualmie NF	Designated
WA	FS	Glacier Peak	Mt Baker/Snoqualmie NF	Designated
WA	FS	Henry M. Jackson	Mt Baker/Snoqualmie NF	Designated
WA	FS	Lake Chelan-Sawtooth	Okanogan NF	Designated
WA	FS	Lake Chelan-Sawtooth	Wenatchee NF	Designated
WA	FS	Mt. Baker	Mt Baker/Snoqualmie NF	Designated
WA	FS	Noisy-Diobsud	Mt Baker/Snoqualmie NF	Designated
WA	FS	Norse Peak	Mt Baker/Snoqualmie NF	Designated
WA	FS	Salmo-Priest	Colville NF	Designated
WA	NPS	Olympic	Olympic NP	Designated
WI	FS	Blackjack Springs	Chequamegon_Nicolet NF	Designated
WI	FS	Headwaters	Chequamegon_Nicolet NF	Designated
WI	FS	Porcupine Lake	Chequamegon_Nicolet NF	Designated
WI	FS	Rainbow Lake	Chequamegon_Nicolet NF	Designated
WI	FS	Whisker Lake	Chequamegon_Nicolet NF	Designated
WV	FS	Cranberry	Monongahela NF	Designated
WV	FS	Dolly Sods	Monongahela NF	Designated
WV	FS	Laurel Fork North	Monongahela NF	Designated
WV	FS	Laurel Fork South	Monongahela NF	Designated
WV	FS	Otter Creek	Monongahela NF	Designated
WY	FS	Absaroka-Beartooth	Shoshone NF	Designated
WY	FS	Cloud Peak	Big Horn NF	Designated
WY	FS	Encampment River	Brush Cr/ Hayden RD	Designated
WY	FS	Fitzpatrick	Washakie RD	Designated
WY	FS	Gros Venture	Bridger Teton NF	Designated
WY	FS	Huston Park	Brush Cr/ Hayden RD	Designated
WY	FS	N. Absaroka	Shoshone NF	Designated
WY	FS	Platte River	Brush Cr/ Hayden RD	Designated
WY	FS	Popo Agie	Shoshone NF	Designated
WY	FS	Teton	Bridger-Teton NF	Designated
WY	FS	Washakie	Shoshone NF	Designated
WY	FS	Wind River	Bridger- Teton NF	Designated